

**CALHOUN COUNTY JAIL
ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

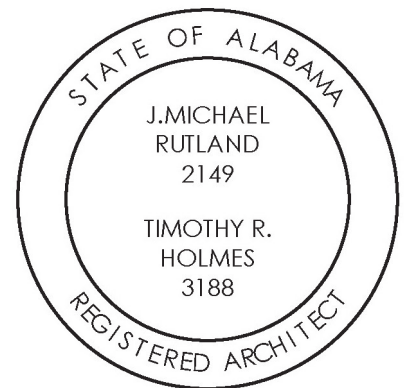
PROJECT MANUAL

JOB NO.: 23-1303
DATE: 12 March 2024
SET NO.: .

JMR+H
Architecture, PC

445 Dexter Avenue
Suite 5050
Montgomery, Al 36104

Phone: (334) 420-5672



**CALHOUN COUNTY JAIL
ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

PROJECT MANUAL

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
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ANNISTON, ALABAMA

00 00 01 Table of Contents

BIDDING REQUIREMENTS

00 01 15 Index to Drawings
00 11 13 Advertisement for Bids
00 12 00 Project Directory
00 21 13 Instructions to Bidders
00 26 00 Prior Approval Request Form
00 42 00 Proposal Form
00 42 01 Sales Tax
00 43 13 Bid Bond
00 52 13 Standard Form of Agreement Between Owner and Contractor
00 61 13.13 Performance Bond
00 61 13.16 Payment Bond
00 62 76 Application and Certificate for Payment
00 62 79 Inventory of Stored Materials
00 62 86 Progress Schedule and Report
00 63 63 Change Order
00 65 13 Form of Advertisement of Completion
00 65 16 Certificate of Substantial Completion
00 65 19.13 Contractor's Affidavit of Payment of Debts and Claims
00 65 19.16 Contractor's Affidavit of Release of Liens
00 65 19.19 Consent of Surety
00 72 00 General Conditions of the Contract
ARPA Awards Terms and Conditions Revenue Replacement Funds
Certificate of Compliance with Beason-Hammond Alabama Tax Payers ad Citizen Protection Act
Certificate of Compliance with ACT 2016-312
W-9
BYRD Anti-Lobbying Amendment
E-Verify

DIVISION 1 GENERAL REQUIREMENTS

01 10 00 Summary of Work
01 21 00 Base Bid Allowances Unit Prices
01 23 00 Alternates
01 31 00 Project Coordination
01 31 19 Project Meeting
01 33 00 Submittals
01 33 23 Shop Drawings, Product Data and Samples
01 40 00 Quality Requirements
01 45 00 Quality Control Systems
01 50 00 Temporary Facilities
01 56 00 Temporary Flooring Protection
01 60 00 Product Requirements
01 71 23 Field Engineering
01 73 29 Cutting and Patching
01 74 23 Final Cleaning
01 77 00 Project Closeout
01 78 23 Operating and Maintenance Data
01 78 29 Field Engineering
01 78 36 Warranties and Bonds
01 78 39 Project Record Documents

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 2 – EXISTING CONDITIONS

02 32 13 Geotechnical Investigations
02 41 13 Selective Site Demolition
02 83 10 Chain Link Fences and Gates

DIVISION 03 - CONCRETE

03 20 00 Concrete Reinforcing
03 30 00 Cast-in-Place Concrete
03 35 43.16 Polished Concrete Floor Finishing
03 39 05 Sealer Hardener for Concrete Floors
03 41 00 Cast Site Concrete
03 41 02 Precast Prestressed Hollow Core
03 41 07 Structural Precast Concrete – Plant Cast
03 45 00 Plant Precast Architectural Concrete
03 62 13 Grout and Epoxy

DIVISION 04 - MASONRY

04 01 20.52 Masonry Cleaning
04 20 00 Unit Masonry
04 21 00 Architectural Face Brick

DIVISION 05 - METALS

05 05 13 Shop Applied Coating for Metal
05 12 00 Structural Steel
05 40 00 Cold-Formed Metal Framing
05 50 00 Metal Fabrications
05 51 00 Metal Stairs
05 52 13 Pipe and Tube Railings

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

06 10 00 Rough Carpentry
06 40 23 Architectural Wood Casework

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07 11 05 Miscellaneous Waterproofing
07 13 00 Sheet Waterproofing
07 19 00 Water Repellents
07 21 00 Building Insulation
07 25 00 Vapor Barrier Building Wrap
07 42 13.19 Insulated Metal Wall Panels
07 50 00 Standing Seam Retrofit Roofing System-LOC Seam Panel
07 60 00 Flashing and Sheet Metal
07 71 00 Roof Specialties and Accessories
07 71 13 Sheet Metal Coping
07 71 23 Gutters and Downspouts
07 84 00 Firestopping
07 92 00 Joint Sealants

DIVISION 08 - OPENINGS

08 11 19 General Door Standard Steel Doors and Frames

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

08 31 00 Access Doors N -S c r a

08 71 00 Door Hardware – General Doors Glazing -
08 80 00 Standard

DIVISION 09 - FINISHES

09 21 16 Gypsum Board Assemblies
09 23 00 Seamless Wall Floor Surface for Shower Floors and Walls
09 51 13 Acoustical Panel Ceilings
09 67 16 Epoxy Flooring
09 83 00 Acoustical Spray Finish
09 90 00 Painting
09 96 53 Elastomeric Coating

DIVISION 10 - SPECIALTIES

10 14 00 Signs
10 20 00 Louvers and Vents
10 28 00 Toilet and Bath Accessories
10 44 00 Fire Extinguisher Cabinets and Accessories

DIVISION 11 - EQUIPMENT

11 19 00 Detention Surface Padding System
11 80 00 Laundry Equipment
11 98 00 Detention Equipment

DIVISION 13 - SPECIAL CONSTRUCTION

13 42 63.13 Equipped Precast Detention Modules -N : r r c r a

DIVISION 21 – FIRE SUPPRESSION

21 05 13 Common Motor Requirements for Fire Suppression Equipment
21 05 17 Sleeves and Sleeve Seals for Fire-Suppression Piping
21 05 18 Escutcheons for Fire-Suppression Piping
21 05 23 General-Duty Valves for Water-Based Fire-Suppression Piping
21 05 29 Hangers and Supports for Fire-Suppression Piping and Equipment
21 05 53 Identification for Fire-Suppression Piping and Equipment
21 13 13 Wet-Pipe Sprinkler Systems

DIVISION 22 – PLUMBING

22 05 10 Basic Mechanical Requirements
22 05 11 Basic Mechanical Materials and Methods
22 05 13 Common Motor Requirements for Plumbing Equipment
22 05 17 Sleeves and Sleeve Seals for Plumbing Piping
22 05 18 Escutcheons for Plumbing Piping
22 05 19 Meters and Gages for Plumbing Piping
22 05 23.12 Ball Valves for Plumbing Piping
22 05 23.14 Check Valves for Plumbing Piping
22 05 23.15 Gate Valves for Plumbing Piping
22 05 29 Hangers and Supports for Plumbing Piping and Equipment
22 05 53 Identification for Plumbing Piping and Equipment
22 07 19 Plumbing Piping Insulation
22 11 16 Domestic Water Piping
22 11 19 Domestic Water Piping Specialties

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

22 11 23 Facility Natural-Gas Piping
22 11 23.21 Inline, Domestic-Water Pumps
22 13 16 Sanitary Waste and Vent Piping
22 13 19 Sanitary Waste Piping Specialties
22 13 19.13 Sanitary Drains
22 34 00 Fuel-Fired, Domestic-Water Heaters
22 42 13.13 Commercial Water Closets
22 42 13.16 Commercial Urinals
22 42 16.13 Commercial Lavatories
22 42 16.16 Commercial Sinks
22 42 23 Commercial Showers

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

23 05 10 Basic Mechanical Requirements
23 05 11 Basic Mechanical Materials and Methods
23 05 13 Common Motor Requirements for HVAC Equipment
23 05 17 Sleeves and Sleeve Seals for HVAC Piping
23 05 29 Hangers and Supports for HVAC Piping and Equipment
23 05 53 Identification for HVAC Piping and Equipment
23 05 93 Testing, Adjusting, and Balancing
23 07 13 Duct Insulation
23 23 00 Refrigerant Piping
23 31 13 Metal Ducts
23 33 00 Duct Accessories
23 37 13 Air Outlets and Inlets

DIVISION 26 – ELECTRICAL

26 05 18 Basic Electrical Materials and Methods
26 05 19 Conductors and Cables
26 05 26 Grounding and Bonding
26 05 33 Raceways and Boxes
26 22 00 Dry Type Transformers (1000 v and less)
26 24 16 Panelboards
26 27 26 Wiring Devices
26 28 13 Fuses
26 28 16 Disconnect Switches
26 32 13 Packaged Engine Generators
26 36 00 Transfer Switches
26 51 00 Interior Lighting

DIVISION 27 COMMUNICATIONS

27 05 25 Communications and Data Processing

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

28 05 13.13 CCTV System
28 31 11 Fire Alarm
28 40 00 Security Electronics System
28 46 19 Programmable Logic Control System
28 50 00 Touch Screen Control System - Theory of Operation
28 51 23 Intercom and Paging System
28 60 00 Locking Control System - Theory of Operation
28 70 00 Inmate Call Switches

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

28 74 00 Uninterruptible Power Supply System
28 75 00 Electronic Control Relay System

28 79 00 Security Equipment Cabinets and Racks
28 80 00 Utility Control Interfaces
28 85 00 Lightning / Surge Suppression
28 90 00 Security Management Server

DIVISION 31 EARTHWORK

31 00 00 Earthwork
31 05 17 Aggregate Materials
31 10 00 Site Clearing
31 23 33 Trenching and Backfilling
31 25 00 Erosion and Sedimentation Controls
31 31 16 Termite Control
31 37 00 Rip Rap

DIVISION 32 EXTERIOR IMPROVEMENTS

32 11 23 Aggregate Base Course
32 12 00 Flexible Paving

DIVISION 33 UTILITIES

33 01 30.13 Sewer and Manole Testing
33 05 13 Manholes and Structures
33 12 00 Water Utility Distribution Equipment
33 12 13 Water Service Connections
33 13 00 Disinfection of Water Utility Distribution
33 31 00 Sanitary Utility Sewerage Piping
33 42 13.13 Public Pipe Culverts
33 44 00 Storm Utility Water Drains

DIVISION 40 PROCESS INTEGRATION

40 05 76.13 Tapping Sleeves and Valves

INDEX OF DRAWINGS

SEQ. NO.	DWG. NO	SHEET TITLE
1	T1.1	COVER, INDEX, LEGENDS, AND NOTES
2	A0.1	ADA STANDARDS
3	TO.1	TOPO
CIVIL		
4	C-101	PROJECT NOTES & BMP PLAN
5	C-102	DEMOLITION PLAN
6	C-301	SITE PLAN
7	C-302	GRADING & DRAINAGE PLAN
8	C-303	UTILITY PLAN
9	C-304	EROSION CONTROL PLAN
10	C-800	CONSTRUCTION DETAILS
11	C-801	CONSTRUCTION DETAILS
12	C-802	CONSTRUCTION DETAILS
ARCHITECTURAL		
13	D1.1	DEMOLITION PLAN & PHOTOS
14	A1.1	FIRST FLOOR DIMENSION PLAN
15	A1.2	FIRST FLOOR KEY & SYMBOL PLAN
16	A1.3	SECOND FLOOR DIMENSION PLAN
17	A1.4	SECOND FLOOR KEY & SYMBOL PLAN
18	A1.5	PLAN DETAILS, FENCE AND GATE DETAILS
19	A1.6	PLENUM PLAN
20	A2.1	FINISH SCHEDULE
21	A3.1	DOOR SCHEDULE
22	A3.2	HOLLOW METAL WINDOW SCHEDULE, DETAILS
23	A4.1	EXTERIOR ELEVATIONS
24	A5.1	BUILDING SECTIONS
25	A5.2	BUILDING SECTIONS
26	A5.3	BUILDING SECTIONS
27	A5.4	BUILDING SECTIONS
28	A6.1	WALL SECTIONS
29	A6.2	WALL SECTIONS
30	A6.3	STAIR SECTIONS
31	A6.4	WALL SECTIONS
32	A7.1	LARGE SCALE PLANS
33	A7.2	INTERIOR ELEVATIONS
34	A8.1	FIRST FLOOR SIGNAGE & REFLECTED CEILING PLANS
35	A8.2	SECOND FLOOR SIGNAGE & REFLECTED CEILING PLANS
36	A9.1	ROOF PLAN

37	A10.1	SECURITY KEY PLANS
38	A10.2	LARGE SCALE MODULES
39	A10.3	SECURITY DETAILS
40	A10.4	SECURITY DETAILS
STRUCTURAL		
41	S1.0	GENERAL NOTES
42	S1.1	GENERAL NOTES CONT.
43	S1.2	TYPICAL DETAILS
44	S1.3	TYPICAL DETAILS
45	S2.0	FIRST FLOOR FOUNDATION PLAN
46	S2.1	SECOND FLOOR FRAMING PLAN
47	S2.2	MODULE ROOF FRAMING PLAN
48	S2.3	ROOF FRAMING PLAN
49	S3.0	SECTIONS
MECHANICAL		
50	P1.1	PLUMBING SCHEDULES, LEGEND, AND NOTES
51	P1.2	PLUMBING DETAILS
52	P2.1	PLUMBING DEMOLITION PLAN
53	P3.1	WASTE & CONDENSATE PLUMBING PLAN
54	P3.2	WASTE PLUMBING RISER DIAGRAMS
55	P4.1	WATER AND GAS PLUMBING PLANS
56	P4.2	WATER & GAS PLUMBING RISER DIAGRAMS
57	SP1.1	FIRE SPRINKLER, SCHEDULES, LEGEND, AND NOTES
58	SP2.1	FIRE SPRINKLER PLUMBING PLAN
59	M1.1	HVAC LEGEND, NOTES, AND SCHEDULES
60	M1.2	HVAC SCHEDULES
61	M1.3	HVAC SCHEDULES & DETAILS
62	M2.1	HVAC DETAILS
63	M2.2	HVAC DETAILS
64	M3.1	HVAC DEMOLITION PLAN
65	M4.1	FIRST FLOOR HVAC PLAN
66	M4.2	SECOND FLOOR HVAC PLAN

OWNER:

CALHOUN COUNTY COMMISSION

Address: 1702 Noble Street, Suite 103
Anniston, Alabama 36201

ARCHITECT:

JMR+H ARCHITECTURE, P.C.

Address: 445 Dexter Avenue, Suite 5050
Montgomery, AL 36104

Business: (334) 420-5672

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Anniston, Alabama 36205

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CIVIL ENGINEER:

CDG Engineering

Caleb Bryant

Email: caleb.bryant@cdge.com

STRUCTURAL ENGINEER:

Harvest Engineering

Brad Harrison

Email: bharrison@harvest-eng.com

PLUMBING / MECHANICAL

WHORTON ENGINEERING, INC

Randy Whorton

E-mail: randy@whortoneng.com

E-mail: draw@whortoneng.com

ELECTRICAL

McCarter Engineering

Stan McCarter

E-mail: smccarter@mccarterengineering.com

ADVERTISEMENT FOR BIDS

Sealed bids will be received by Calhoun County Commission at the offices of Calhoun County Commission, 1702 Noble Street, Suite 103, Anniston, AL 36201 until **2:00 PM, April 18, 2024**, and thereafter opened publicly for the:

CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

Bid documents may be examined at the Office of the Commission and Architect.

Bid Documents may be obtained from the Architect by digital access/file sharing access for a one time administrative fee of \$150.00 (non-refundable; separate check), and/or deposit of \$300.00 per set, which will be refunded in full on the first two (2) sets issued to each bidder submitting a bona fide bid, upon return of documents in good condition and reusable condition within ten (10) days of bid date. Other sets for general contractors, and sets for subcontractors and dealers, may be obtained with the same deposit, which will be refunded as above, less cost of printing, reproduction, handling, and distribution, which is estimated to be the same as the deposit amount. *Partial sets will not be available.* **To expedite distribution of bid documents, deposit check(s) should be emailed and mailed to JMR+H Architecture, PC, Attn: Renae Williams; 445 Dexter Avenue, Suite 5050, Montgomery, Alabama 36104; specs@jmrha.com.**

No bid will be withdrawn after the scheduled closing time for the receipt, for a period of thirty (30) days.

A **PRE-BID CONFERENCE** will be held in the Conference Room at Calhoun County Commission, 1702 Noble Street, Suite 103, Anniston, AL 36201 on **April 9, 2024 at 10:00 AM** (local time prevailing) for the purpose of reviewing the project and answering Bidder's questions. Attendance at the Pre-Bid Conference is highly recommended Contract Bidders intending to submit a Bid.

A cashier's check or bid bond made payable to the Calhoun County Commission in an amount not less than five (5) percent of the amount of the bid, but in no event more than \$10,000, must accompany the bidder's Bid and must secure the bid for at least 60 days. Conditional bids will be rejected. List of major subcontractors must accompany the bid. Performance and Payment Bonds (if award exceeds \$100,000) and evidence of insurance are prerequisites of contract award. Right is reserved by the Awarding Authority to reject all bids and to waive irregularities, if such action is determined by the Awarding Authority to be in their best interest.

CALHOUN COUNTY COMMISSION
1702 Noble Street, Suite 103
Anniston, Alabama 36201
Telephone : (256) 241-2800

JMR+H Architecture, PC
445 Dexter Avenue, Suite 5050
Montgomery, AL 36104
Telephone: (334) 420-5672
Fax: (334) 420-5692



AIA® Document A701® – 2018

Instructions to Bidders

for the following Project:
(Name, location, and detailed description)

CALHOUN COUNTY JAIL
ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

THE OWNER:

(Name, legal status, address, and other information)

Calhoun County Commission
1702 Noble Street, Suite 103
Anniston, Alabama 36201
Telephone Number: 256-241-2800
Fax Number: 256-231-1744

THE ARCHITECT:

(Name, legal status, address, and other information)

JMR+H Architecture, PC
445 Dexter Avenue, Suite 5050
Montgomery, Alabama 36104
Telephone Number: 334-420-5672
Fax Number: 334-420-5692

Jay Jenkins
Associate Architect
Jay Jenkins Architecture
301 Buckner Circle
Anniston, Alabama 36205

ADDITIONS AND DELETIONS:

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

FEDERAL, STATE, AND LOCAL
LAWS MAY IMPOSE
REQUIREMENTS ON PUBLIC
PROCUREMENT CONTRACTS.
CONSULT LOCAL AUTHORITIES
OR AN ATTORNEY TO VERIFY
REQUIREMENTS APPLICABLE TO
THIS PROCUREMENT BEFORE
COMPLETING THIS FORM.

It is intended that AIA Document G612™-2017, Owner's Instructions to the Architect, Parts A and B will be completed prior to using this document.

TABLE OF ARTICLES

1	DEFINITIONS
2	BIDDER'S REPRESENTATIONS
3	BIDDING DOCUMENTS
4	BIDDING PROCEDURES
5	CONSIDERATION OF BIDS
6	POST-BID INFORMATION
7	PERFORMANCE BOND AND PAYMENT BOND
8	ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

ARTICLE 1 DEFINITIONS

§ 1.1 Bidding Documents include the Bidding Requirements and the Proposed Contract Documents. The Bidding Requirements consist of the advertisement or invitation to bid, Instructions to Bidders, supplementary instructions to bidders, the bid form, and any other bidding forms. The Proposed Contract Documents consist of the unexecuted form of Agreement between the Owner and Contractor and that Agreement's Exhibits, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, all Addenda, and all other documents enumerated in Article 8 of these Instructions.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, or in other Proposed Contract Documents apply to the Bidding Documents.

§ 1.3 Addenda are written or graphic instruments issued by the Architect, which, by additions, deletions, clarifications, or corrections, modify or interpret the Bidding Documents.

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

§ 1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents, to which Work may be added or deleted by sums stated in Alternate Bids.

§ 1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from, or that does not change, the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

§ 1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, as described in the Bidding Documents.

§ 1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

§ 1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment, or labor for a portion of the Work.

ARTICLE 2 BIDDER'S REPRESENTATIONS

§ 2.1 By submitting a Bid, the Bidder represents that:

- .1 the Bidder has read and understands the Bidding Documents;
- .2 the Bidder understands how the Bidding Documents relate to other portions of the Project, if any, being bid concurrently or presently under construction;
- .3 the Bid complies with the Bidding Documents;
- .4 the Bidder has visited the site, become familiar with local conditions under which the Work is to be performed, and has correlated the Bidder's observations with the requirements of the Proposed Contract Documents;
- .5 the Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception; and
- .6 the Bidder has read and understands the provisions for liquidated damages, if any, set forth in the form of Agreement between the Owner and Contractor.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 Distribution

§ 3.1.1 Bidders shall obtain complete Bidding Documents, as indicated below, from the issuing office designated in the advertisement or invitation to bid, for the deposit sum, if any, stated therein.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall obtain Bidding Documents.)

§ 3.1.2 Any required deposit shall be refunded to Bidders who submit a bona fide Bid and return the paper Bidding Documents in good condition within ten days after receipt of Bids. The cost to replace missing or damaged paper documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the paper Bidding Documents, and the Bidder's deposit will be refunded.

§ 3.1.3 Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the advertisement or invitation to bid, or in supplementary instructions to bidders.

§ 3.1.4 Bidders shall use complete Bidding Documents in preparing Bids. Neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete Bidding Documents.

§ 3.1.5 The Bidding Documents will be available for the sole purpose of obtaining Bids on the Work. No license or grant of use is conferred by distribution of the Bidding Documents.

§ 3.2 Modification or Interpretation of Bidding Documents

§ 3.2.1 The Bidder shall carefully study the Bidding Documents, shall examine the site and local conditions, and shall notify the Architect of errors, inconsistencies, or ambiguities discovered and request clarification or interpretation pursuant to Section 3.2.2.

§ 3.2.2 Requests for clarification or interpretation of the Bidding Documents shall be submitted by the Bidder in writing and shall be received by the Architect at least seven days prior to the date for receipt of Bids.
(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall submit requests for clarification and interpretation.)

§ 3.2.3 Modifications and interpretations of the Bidding Documents shall be made by Addendum. Modifications and interpretations of the Bidding Documents made in any other manner shall not be binding, and Bidders shall not rely upon them.

§ 3.3 Substitutions

§ 3.3.1 The materials, products, and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution.

§ 3.3.2 Substitution Process

§ 3.3.2.1 Written requests for substitutions shall be received by the Architect at least ten days prior to the date for receipt of Bids. Requests shall be submitted in the same manner as that established for submitting clarifications and interpretations in Section 3.2.2.

§ 3.3.2.2 Bidders shall submit substitution requests on a Substitution Request Form if one is provided in the Bidding Documents.

§ 3.3.2.3 If a Substitution Request Form is not provided, requests shall include (1) the name of the material or equipment specified in the Bidding Documents; (2) the reason for the requested substitution; (3) a complete description of the proposed substitution including the name of the material or equipment proposed as the substitute, performance and test data, and relevant drawings; and (4) any other information necessary for an evaluation. The request shall include a statement setting forth changes in other materials, equipment, or other portions of the Work, including changes in the work of other contracts or the impact on any Project Certifications (such as LEED), that will result from incorporation of the proposed substitution.

§ 3.3.3 The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

§ 3.3.4 If the Architect approves a proposed substitution prior to receipt of Bids, such approval shall be set forth in an Addendum. Approvals made in any other manner shall not be binding, and Bidders shall not rely upon them.

§ 3.3.5 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

§ 3.4 Addenda

§ 3.4.1 Addenda will be transmitted to Bidders known by the issuing office to have received complete Bidding Documents.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Addenda will be transmitted.)

§ 3.4.2 Addenda will be available where Bidding Documents are on file.

§ 3.4.3 Addenda will be issued no later than four days prior to the date for receipt of Bids, except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

§ 3.4.4 Prior to submitting a Bid, each Bidder shall ascertain that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Bids

§ 4.1.1 Bids shall be submitted on the forms included with or identified in the Bidding Documents.

§ 4.1.2 All blanks on the bid form shall be legibly executed. Paper bid forms shall be executed in a non-erasable medium.

§ 4.1.3 Sums shall be expressed in both words and numbers, unless noted otherwise on the bid form. In case of discrepancy, the amount entered in words shall govern.

§ 4.1.4 Edits to entries made on paper bid forms must be initialed by the signer of the Bid.

§ 4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change" or as required by the bid form.

§ 4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder's refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall neither make additional stipulations on the bid form nor qualify the Bid in any other manner.

§ 4.1.7 Each copy of the Bid shall state the legal name and legal status of the Bidder. As part of the documentation submitted with the Bid, the Bidder shall provide evidence of its legal authority to perform the Work in the jurisdiction where the Project is located. Each copy of the Bid shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further name the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached, certifying the agent's authority to bind the Bidder.

§ 4.1.8 A Bidder shall incur all costs associated with the preparation of its Bid.

§ 4.2 Bid Security

§ 4.2.1 Each Bid shall be accompanied by the following bid security:

(Insert the form and amount of bid security.)

§ 4.2.2 The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and shall, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. In the event the Owner fails to comply with Section 6.2, the amount of the bid security shall not be forfeited to the Owner.

§ 4.2.3 If a surety bond is required as bid security, it shall be written on AIA Document A310™, Bid Bond, unless otherwise provided in the Bidding Documents. The attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of an acceptable power of attorney. The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 4.2.4 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until (a) the Contract has been executed and bonds, if required, have been furnished; (b) the specified time has elapsed so that Bids may be withdrawn; or (c) all Bids have been rejected. However, if no Contract has been awarded or a Bidder has not been notified of the acceptance of its Bid, a Bidder may, beginning days after the opening of Bids, withdraw its Bid and request the return of its bid security.

§ 4.3 Submission of Bids

§ 4.3.1 A Bidder shall submit its Bid as indicated below:

(Indicate how, such as by website, host site/platform, paper copy, or other method Bidders shall submit their Bid.)

§ 4.3.2 Paper copies of the Bid, the bid security, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder's name and address, and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

§ 4.3.3 Bids shall be submitted by the date and time and at the place indicated in the invitation to bid. Bids submitted after the date and time for receipt of Bids, or at an incorrect place, will not be accepted.

§ 4.3.4 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

§ 4.3.5 A Bid submitted by any method other than as provided in this Section 4.3 will not be accepted.

§ 4.4 Modification or Withdrawal of Bid

§ 4.4.1 Prior to the date and time designated for receipt of Bids, a Bidder may submit a new Bid to replace a Bid previously submitted, or withdraw its Bid entirely, by notice to the party designated to receive the Bids. Such notice shall be received and duly recorded by the receiving party on or before the date and time set for receipt of Bids. The receiving party shall verify that replaced or withdrawn Bids are removed from the other submitted Bids and not considered. Notice of submission of a replacement Bid or withdrawal of a Bid shall be worded so as not to reveal the amount of the original Bid.

§ 4.4.2 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids in the same format as that established in Section 4.3, provided they fully conform with these Instructions to Bidders. Bid security shall be in an amount sufficient for the Bid as resubmitted.

§ 4.4.3 After the date and time designated for receipt of Bids, a Bidder who discovers that it made a clerical error in its Bid shall notify the Architect of such error within two days, or pursuant to a timeframe specified by the law of the jurisdiction where the Project is located, requesting withdrawal of its Bid. Upon providing evidence of such error to the reasonable satisfaction of the Architect, the Bid shall be withdrawn and not resubmitted. If a Bid is withdrawn pursuant to this Section 4.4.3, the bid security will be attended to as follows:

(State the terms and conditions, such as Bid rank, for returning or retaining the bid security.)

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

If stipulated in an advertisement or invitation to bid, or when otherwise required by law, Bids properly identified and received within the specified time limits will be publicly opened and read aloud. A summary of the Bids may be made available to Bidders.

§ 5.2 Rejection of Bids

Unless otherwise prohibited by law, the Owner shall have the right to reject any or all Bids.

§ 5.3 Acceptance of Bid (Award)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest responsive and responsible Bidder, provided the Bid has been submitted in accordance with the requirements of the Bidding Documents. Unless otherwise prohibited by law, the Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's best interests.

§ 5.3.2 Unless otherwise prohibited by law, the Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the lowest responsive and responsible Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION

§ 6.1 Contractor's Qualification Statement

Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request and within the timeframe specified by the Architect, a properly executed AIA Document A305™, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted for this Bid.

§ 6.2 Owner's Financial Capability

A Bidder to whom award of a Contract is under consideration may request in writing, fourteen days prior to the expiration of the time for withdrawal of Bids, that the Owner furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. The Owner shall then furnish such reasonable evidence to the Bidder no later than seven days prior to the expiration of the time for withdrawal of Bids. Unless such reasonable evidence is furnished within the allotted time, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

§ 6.3 Submittals

§ 6.3.1 After notification of selection for the award of the Contract, the Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, submit in writing to the Owner through the Architect:

- .1 a designation of the Work to be performed with the Bidder's own forces;
- .2 names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each; and
- .3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

§ 6.3.2 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, withdraw the Bid or submit an acceptable substitute person or entity. The Bidder may also submit any required adjustment in the Base Bid or Alternate Bid to account for the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

§ 6.3.4 Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 Bond Requirements

§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder.

§ 7.1.2 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

§ 7.1.3 The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 7.1.4 Unless otherwise indicated below, the Penal Sum of the Payment and Performance Bonds shall be the amount of the Contract Sum.

(If Payment or Performance Bonds are to be in an amount other than 100% of the Contract Sum, indicate the dollar amount or percentage of the Contract Sum.)

§ 7.2 Time of Delivery and Form of Bonds

§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to commence sooner in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond.

§ 7.2.3 The bonds shall be dated on or after the date of the Contract.

§ 7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix to the bond a certified and current copy of the power of attorney.

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

§ 8.1 Copies of the proposed Contract Documents have been made available to the Bidder and consist of the following documents:

- .1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

- .2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

- .3 AIA Document A201™–2017, General Conditions of the Contract for Construction, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

- .4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013.)

- .5 Drawings

PROPOSAL FORM

To: Calhoun County Commission Date: _____
(Awarding Authority)

In compliance with the Advertisement for Bids and subject to all the conditions thereof, the undersigned

(Legal Name of Bidder)

hereby proposes to furnish all labor and materials and perform all work required for the construction of

**WORK CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS MENTAL HEALTH /
MEDICAL UNIT, ANNISTON, ALABAMA**

in accordance with Drawings and Specifications, dated _____, prepared by
JMR+H Architecture, PC, 445 Dexter Avenue, Suite 5050, Montgomery, AL 36104, Architect/Engineer.

The Bidder, which is organized and existing under the laws of the State of _____,
having its principal offices in the City of _____,
is: a Corporation a Partnership an Individual (other) _____.

LISTING OF PARTNERS OR OFFICERS: If Bidder is a Partnership, list all partners and their addresses; if Bidder is a Corporation, list the names, titles, and business addresses of its officers:

BIDDER'S REPRESENTATION: The Bidder declares that it has examined the site of the Work, having become fully informed regarding all pertinent conditions, and that it has examined the Drawings and Specifications (including all Addenda received) for the Work and the other Bid and Contract Documents relative thereto, and that it has satisfied itself relative to the Work to be performed.

ADDENDA: The Bidder acknowledges receipt of Addenda Nos. _____ through _____ inclusively.

BID ITEM A: Sitework, the sum of _____ Dollars (\$ _____)

BID ITEM B: Remainder of project excluding Bid Item C, the sum of _____ Dollars (\$ _____)

BID ITEM C: HVAC and Electrical Work Supporting HVAC, the sum of _____ Dollars (\$ _____)

ALTERNATES: If alternates as set forth in the Bid Documents are accepted, the following adjustments are to be made to the Base Bid:

BID ITEM B – ALTERNATE NO. 1: Generator, the sum of _____ Dollars (\$ _____)

BID ITEM B – ALTERNATE NO. 2: Male and Female Medical Evaluation Beds – Second Floor, the sum of _____ Dollars (\$ _____)

BID ITEM B – ALTERNATE NO. 3: Cameras in Cells, the sum of _____ Dollars (\$ _____)

BID ITEM B – ALTERNATE NO. 4: Telemedicine, the sum of _____ Dollars (\$ _____)

BID SECURITY: The undersigned agrees to enter into a Construction Contract and furnish the prescribed Performance and Payment Bonds and evidence of insurance within fifteen calendar days, or such other period stated in the Bid Documents, after the contract forms have been presented for signature, provided such presentation is made within 30 calendar days after the opening of bids, or such other period stated in the Bid Documents. As security for this condition, the undersigned further agrees that the funds represented by the Bid Bond (or cashier's check) attached hereto may be called and paid into the account of the Awarding Authority as liquidated damages for failure to so comply.

Attached hereto is a: *(Mark the appropriate box and provide the applicable information.)*

- Bid Bond, executed by _____ as Surety,
- a cashier's check on the _____ Bank of _____,
for the sum of _____
Dollars (\$ _____) made payable to the Awarding Authority.

BIDDER'S ALABAMA LICENSE:

State License for General Contracting: _____
License Number Bid Limit Type(s) of Work

CERTIFICATIONS: The undersigned certifies that he or she is authorized to execute contracts on behalf of the Bidder as legally named, that this proposal is submitted in good faith without fraud or collusion with any other bidder, that the information indicated in this document is true and complete, and that the bid is made in full accord with State law. Notice of acceptance may be sent to the undersigned at the address set forth below.

The Bidder also declares that a list of all proposed major subcontractors and suppliers will be submitted at a time subsequent to the receipt of bids as established by the Architect in the Bid Documents but in no event shall this time exceed twenty-four (24) hours after receipt of bids.

Legal Name of Bidder _____

Mailing Address _____

* **By (Legal Signature)** _____

* Name (type or print) _____ (Seal)

* Title _____

Telephone Number _____

* If other than the individual proprietor, or an above-named member of the Partnership, or the above-named president, vice-president, or secretary of the Corporation, attach written authority to bind the Bidder. Any modification to a bid shall be over the initials of the person signing the bid, or of an authorized representative.

ACCOUNTING OF SALES TAX

Attachment to Proposal Form

To: Calhoun County Commission Date: _____
(Awarding Authority)

NAME OF PROJECT CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS MENTAL HEALTH / MEDICAL UNIT, ANNISTON, ALABAMA

SALES TAX ACCOUNTING

Pursuant to Act 2013-205, Section 1(g) the Contractor accounts for the sales tax NOT included in the bid proposal form as follows:

ESTIMATED SALES TAX AMOUNT

BID ITEM A: Sitework	(\$ _____)
BID ITEM B: Remainder of project excluding Bid Item C	(\$ _____)
BID ITEM C: HVAC and Electrical Work Supporting HVAC	(\$ _____)

ALTERNATES: If alternates as set forth in the Bid Documents are accepted, the following adjustments are to be made to the Base Bid:

BID ITEM B, ALTERNATE NO. 1: Generator	(\$ _____)
BID ITEM B, ALTERNATE NO. 2: Male/ Female Medical Beds	(\$ _____)
BID ITEM B, ALTERNATE NO. 3: Cameras in Cells	(\$ _____)
BID ITEM B, ALTERNATE NO. 4: Telemedicine	(\$ _____)

Failure to provide an accounting of sales tax shall render the bid non-responsive. Other than determining responsiveness, sales tax accounting shall not affect the bid pricing nor be considered in the determination of the lowest responsible and responsive bidder.

Legal Name of Bidder _____

Mailing Address _____

***By (Legal Signature)** _____

***Name (type or print)** _____

(Seal)

***Title** _____

Telephone Number _____

Email Address _____

PRIOR APPROVAL

1. **SUBSTITUTIONS:** Where prior approval is required in specifications, bidders shall submit written requests at least ten (10) calendar days before the opening of bids for general contract. Requests received after this time shall not be considered. Requests shall clearly describe the product for which approval is asked, including all data necessary to demonstrate acceptability. Base requests shall also include a confirmation that product will be ready for delivery to job site in accordance with the need of general contractor or sub-contractors. If the substitution is acceptable, the Architect shall approve the product in an Addendum. Based upon limited availability of time, the review for Prior Approval during the bidding process is cursory and not exact. Prior Approval at this stage gives a vendor the right to submit a proposal based upon his certification / representation that the product is equal in every way. The burden of proof of equality lies with the requesting vendor, not the Architect or his consultants. Any product misrepresented by any vendor as equal will be subject to complete rejection at the time of formal submittal review. General Contractors, subcontractors and vendors shall be fully responsible for the coordination of and adherence to this criteria.

2. **SUBMISSION:** Following is a form to be used for submission of request to Architect for approval of substitutes and/or unspecified products. Submission shall be made on bidder's letterhead and submitted to Architect. Make separate submission for each substitute item.

REQUEST FOR PRIOR APPROVAL OF SUBSTITUTE

Product No. _____ and Title: _____

Project Location: _____

Bidder's License No., if project is in State requiring General Contractors to be licensed:

Specifications or Drawings Reference: Section No. _____ Page _____

Paragraph _____ Drawing No. _____

Specified Item: _____

Submitted Item: _____

List of Three Installations: _____

(Give project name and location): _____

Differences between specified item and submitted item, if any: _____

Signed: _____

Date: _____



AIA® Document A310™ – 2010

Bid Bond

CONTRACTOR:

(Name, legal status and address)

SURETY:

(Name, legal status and principal place of business)

OWNER:

(Name, legal status and address)

Calhoun County Commission
1702 Noble Street, Suite 103
Anniston, Alabama 36201
Telephone Number: 256-241-2800
Fax Number: 256-231-1744

BOND AMOUNT: \$**PROJECT:**

(Name, location or address, and Project number, if any)

CALHOUN COUNTY JAIL
ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or

ADDITIONS AND DELETIONS:

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged where the author has added to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.



AIA® Document A101® – 2017

Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum

AGREEMENT made as of the day of in the year
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

Calhoun County Commission
1702 Noble Street, Suite 103
Anniston, Alabama 36201
Telephone Number: 256-241-2800
Fax Number: 256-231-1744

and the Contractor:
(Name, legal status, address and other information)

for the following Project:
(Name, location and detailed description)

CALHOUN COUNTY JAIL
ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

The Architect:
(Name, legal status, address and other information)

JMR+H Architecture, PC
445 Dexter Avenue, Suite 5050
Montgomery, Alabama 36104
Telephone Number: 334-420-5672
Fax Number: 334-420-5692

Jay Jenkins
Associate Architect
Jay Jenkins Architecture
301 Buckner Circle
Anniston, Alabama 36205

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS:

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

The parties should complete A101®–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201®–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

Init.

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TABLE OF ARTICLES

1	THE CONTRACT DOCUMENTS
2	THE WORK OF THIS CONTRACT
3	DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION
4	CONTRACT SUM
5	PAYMENTS
6	DISPUTE RESOLUTION
7	TERMINATION OR SUSPENSION
8	MISCELLANEOUS PROVISIONS
9	ENUMERATION OF CONTRACT DOCUMENTS

EXHIBIT A INSURANCE AND BONDS

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:

(Check one of the following boxes.)

- The date of this Agreement.
- A date set forth in a notice to proceed issued by the Owner.
- Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:

(Check one of the following boxes and complete the necessary information.)

[] Not later than () calendar days from the date of commencement of the Work.

[] By the following date:

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work

Substantial Completion Date

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be (\$), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item

Price

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement. *(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)*

Item

Price

Conditions for Acceptance

§ 4.3 Allowances, if any, included in the Contract Sum: *(Identify each allowance.)*

Item

Price

§ 4.4 Unit prices, if any:

(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item

Units and Limitations

Price per Unit (\$0.00)

§ 4.5 Liquidated damages, if any:

(Insert terms and conditions for liquidated damages, if any.)

§ 4.6 Other:

(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the day of the month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than () days after the Architect receives the Application for Payment. *(Federal, state or local laws may require payment within a certain period of time.)*

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

- .1 That portion of the Contract Sum properly allocable to completed Work;
- .2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and
- .3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

- .1 The aggregate of any amounts previously paid by the Owner;
- .2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;
- .3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
- .4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and
- .5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:

(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

§ 5.1.7.1.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:
(Insert any other conditions for release of retainage upon Substantial Completion.)

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

§ 5.1.9 Except with the Owner’s prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

- .1 the Contractor has fully performed the Contract except for the Contractor’s responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and
- .2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner’s final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect’s final Certificate for Payment, or as follows:

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

(Insert rate of interest agreed upon, if any.)

%

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.

(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

§ 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:

(Check the appropriate box.)

- Arbitration pursuant to Section 15.4 of AIA Document A201–2017
- Litigation in a court of competent jurisdiction
- Other *(Specify)*

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

§ 7.1.1 If the Contract is terminated for the Owner’s convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:

(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner’s convenience.)

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner’s representative:

(Name, address, email address, and other information)

§ 8.3 The Contractor’s representative:

(Name, address, email address, and other information)

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:

(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

§ 8.7 Other provisions:

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

- .1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor
- .2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds
- .3 AIA Document A201™–2017, General Conditions of the Contract for Construction
- .4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013 incorporated into this Agreement.)

.5 Drawings

Number	Title	Date
--------	-------	------

.6 Specifications

Section	Title	Date	Pages
---------	-------	------	-------

.7 Addenda, if any:

Number	Date	Pages
--------	------	-------

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

.8 Other Exhibits:

(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 incorporated into this Agreement.)

[] The Sustainability Plan:

Title	Date	Pages
-------	------	-------

[] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
----------	-------	------	-------

.9 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor’s bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

This Agreement entered into as of the day and year first written above.

OWNER (Signature)

(Printed name and title)

CONTRACTOR (Signature)

(Printed name and title)



AIA[®]

Document A312[®] – 2010

Performance Bond

CONTRACTOR:

(Name, legal status and address)

SURETY:

(Name, legal status and principal place of business)

OWNER:

(Name, legal status and address)

Calhoun County Commission
1702 Noble Street, Suite 103
Anniston, Alabama 36201
Telephone Number: 256-241-2800
Fax Number: 256-231-1744

CONSTRUCTION CONTRACT

State:

Amount: \$0.00

Description:

(Name and location)

CAUYJ I N CJ I NTD &RU
AS \$ RTR NS E VMNJ / ATR NS
P MNTAU YMAUTY KP M\$ RCAUI NRT
ANNISTJ N, AUAd AP A

BOND

State:

(Not earlier than Construction Contract Date)

Amount: \$

Provisions to this bond: None See Section 16

CONTRACTOR AS PRINCIPAL

Company: *(Corporate Seal)*

Signature: _____

Name and

Title:

(Any additional signatures appear on the last page of this Performance Bond.)

SURETY

Company: *(Corporate Seal)*

Signature: _____

Name and

Title:

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or BROKER:

OWNER'S REPRESENTATIVE:

(Architect, Engineer or other party:)

ADDITIONS AND DELETIONS:

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this document, except when applicable to participate in a Conference as provided in Section 3H.

§ 3 If there is no Owner default under the Construction Contract, the Surety's obligation under this document shall arise after:

1. the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor default. Such notice shall include whether the Owner is requesting a Conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a Conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a Conference. If the Surety timely requests a Conference, the Owner shall attend unless the Owner agrees otherwise. Any Conference requested under this Section 3H shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not deprive the Owner's right, if any, subsequently to declare a Contractor default.
2. the Owner declares a Contractor default, terminates the Construction Contract and notifies the Surety and
3. the Owner has agreed to pay the balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a Contractor selected to perform the Construction Contract.

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3H shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates a clear prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly advance the Surety's expense to one of the following actions:

§ 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract.

§ 5.2 Intervene to perform and complete the Construction Contract itself, through its agents or independent Contractors.

§ 5.3 Obtain bids or negotiate proposals from qualified Contractors acceptable to the Owner for a Contractor for performance and completion of the Construction Contract, arrange for a Contractor to be prepared for execution by the Owner and a Contractor selected with the Owner's consent, to be secured with performance and payment bonds executed by a qualified surety, and consent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as set forth in Section 7 in excess of the balance of the Contract Price incurred by the Owner as a result of the Contractor's default.

§ 5.4 Advise its right to perform and complete, arrange for completion, or obtain a new Contractor and, with reasonable promptness under the circumstances:

1. After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner.
2. Any liability in whole or in part and notify the Owner, stating the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this document seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this document and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5H, and the Owner refuses the payment or the Surety has no liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

§ 7 If the Surety elects to answer Section 5H, 5H or 5H, then the responsibilities of the Surety to the J . ner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the J . ner to the Surety shall not be greater than those of the J . ner under the Construction Contract. Subject to the Commitment by the J . ner to pay the balance of the Contract Price, the Surety is obligated, without duplication, for

- 1 the responsibilities of the Contractor for Correction of defective work and completion of the Construction Contract
- 2 additional legal, supervisory professional and delay costs resulting from the Contractor's default, and resulting from the actions or failure to act of the Surety under Section 5H
- 3 liabilities which, or if no liabilities which are specified in the Construction Contract, a Qualifies by way of performance or non-performance of the Contractor

§ 8 If the Surety elects to answer Section 5H, 5H or 5H, the Surety's liability is limited to the amount of this bond

§ 9 The Surety shall not be liable to the J . ner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the balance of the Contract Price shall not be recovered or set off on account of any such unrelated obligations. No right of action shall accrue on this bond to any person or entity other than the J . ner or its heirs, executors, administrators, successors and assigns

§ 10 The Surety hereby agrees notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchases or other obligations

§ 11 Any proceeding, legal or equitable, under this bond may be instituted in any Court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor's default or within two years after the Contractor ceases work or within two years after the Surety refuses or fails to perform its obligations under this bond. However, the provisions of this paragraph are subject to the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable

§ 12 Notice to the Surety, the J . ner or the Contractor shall be mailed or delivered to the address shown on the bond in which their signature appears

§ 13 When this bond has been furnished to comply with a statutory or other legal requirement in the location where the Construction work is to be performed, any provision in this bond conflicting with said statutory or legal requirement shall be deemed to be deleted wherefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated therein. When so furnished, the intent is that this bond shall be construed as a statutory bond and not as a common law bond

§ 14 Definitions

§ 14.1 **Balance of the Contract Price.** The total amount payable by the J . ner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the J . ner in settlement of insurance or other claims for damages to which the Contractor is entitled, recovered by all jointly or proper payments made to or on behalf of the Contractor under the Construction Contract

§ 14.2 **Construction Contract.** The agreement between the J . ner and Contractor identified on the job or pave, including all Contract documents and changes made to the agreement and the Contract documents

§ 14.3 **Contractor Default.** Failure of the Contractor, which has not been remedied or agreed to perform or otherwise to comply with a material term of the Construction Contract

§ 14.4 **Owner Default.** Failure of the J . ner, which has not been remedied or agreed to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract

§ 14.5 **Contract Documents.** All the documents that comprise the agreement between the J . ner and Contractor

§ 15 If this document is issued for an agreement between a Contractor and Subcontractor, the term Contractor in this document shall be deemed to be Subcontractor and the term Joint Owner shall be deemed to be Contractor.

§ 16 Provisions to this bond are as follows:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL

Company: _____ (Corporate Seal)

Signature: _____
Name and Title: _____
Address: _____

SURETY

Company: _____ (Corporate Seal)

Signature: _____
Name and Title: _____
Address: _____



AIA[®]

Document A312[®] – 2010

Payment Bond

CONTRACTOR:

(Name, legal status and address)

SURETY:

(Name, legal status and principal place of business)

OWNER:

(Name, legal status and address)

Calhoun County Commission
1702 Noble Street, Suite 103
Anniston, Alabama 36201
Telephone Number: 256-241-2800
Fax Number: 256-231-1744

CONSTRUCTION CONTRACT

Date:

Amount: \$ 0.00

Description:

(Name and location)

CALHOUN COUNTY JAIL
ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

BOND

Date:

(Not earlier than Construction Contract Date)

Amount: \$

Modifications to this Bond: None See Section 18

CONTRACTOR AS PRINCIPAL

Company: *(Corporate Seal)*

SURETY

Company: *(Corporate Seal)*

Signature: _____

Name and

Title:

(Any additional signatures appear on the last page of this Payment Bond.)

Signature: _____

Name and

Title:

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or BROKER:

OWNER'S REPRESENTATIVE:

(Architect, Engineer or other party:)

ADDITIONS AND DELETIONS:

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

- .1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
- .2 have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§ 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

§ 10 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

§ 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum:

- .1 the name of the Claimant;
- .2 the name of the person for whom the labor was done, or materials or equipment furnished;
- .3 a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
- .4 a brief description of the labor, materials or equipment furnished;
- .5 the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
- .6 the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
- .7 the total amount of previous payments received by the Claimant; and
- .8 the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

§ 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

§ 16.4 **Owner Default.** Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 16.5 **Contract Documents.** All the documents that comprise the agreement between the Owner and Contractor.

§ 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 18 Modifications to this bond are as follows:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL

SURETY

Company: _____ (Corporate Seal)

Company: _____ (Corporate Seal)

Signature: _____
Name and Title: _____
Address: _____

Signature: _____
Name and Title: _____
Address: _____

AIA® Document G702® – 1992

Application and Certificate for Payment

TO OWNER: Calhoun County Commission 1702 Noble Street, Suite 103 Anniston, Alabama 36201	PROJECT: Calhoun County Jail Additions and Renovations Mental Health / Medical Unit Anniston, Alabama JMR+H Architecture, PC 445 Dexter Avenue, Suite 5050 Montgomery, Alabama 36104 Jay VIA ARCHITECT: Jenkins Architecture 301 Buckner Circle Anniston, Alabama 36205	APPLICATION NO: 001 PERIOD TO: CONTRACT FOR: General Construction CONTRACT DATE: PROJECT NOS: 18-786 / /	Distribution to: OWNER: <input type="checkbox"/> ARCHITECT: <input type="checkbox"/> CONTRACTOR: <input type="checkbox"/> FIELD: <input type="checkbox"/> OTHER: <input type="checkbox"/>
---	---	---	---

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract. AIA Document G703®, Continuation Sheet, is attached.

1. ORIGINAL CONTRACT SUM	0.00
2. NET CHANGE BY CHANGE ORDERS	0.00
3. CONTRACT SUM TO DATE (Line 1 ± 2)	0.00
4. TOTAL COMPLETED & STORED TO DATE (Column G on G703)	0.00
5. RETAINAGE:	
a. 0 % of Completed Work (Column D + E on G703)	0.00
b. 0 % of Stored Material (Column F on G703)	0.00
Total Retainage (Lines 5a + 5b or Total in Column I of G703)	0.00
6. TOTAL EARNED LESS RETAINAGE	0.00
(Line 4 Less Line 5 Total)	
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT	0.00
(Line 6 from prior Certificate)	
8. CURRENT PAYMENT DUE	0.00
9. BALANCE TO FINISH, INCLUDING RETAINAGE (Line 3 less Line 6)	0.00

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:

By: _____ Date: _____

State of: _____

County of: _____

Subscribed and sworn to before
me this _____ day of _____

Notary Public:

My Commission expires: _____

ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on on-site observations and the data comprising this application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED 0.00

(Attach explanation if amount certified differs from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are changed to conform with the amount certified.)

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner	0.00	0.00
Total approved this Month	0.00	0.00
TOTALS	0.00	0.00
NET CHANGES by Change Order		0.00

ARCHITECT:

By: _____

Date: _____

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

INVENTORY OF STORED MATERIALS

Project:

For Estimate No. _____

Contractor:

For Period Ending _____

A	B	C	D	E	F
DESCRIPTION	MATERIALS STORED LAST PERIOD	PURCHASED THIS PERIOD	TOTAL COLUMNS B + C	MATERIALS USED THIS PERIOD	MATERIALS PRESENTLY STORED

To be used as documentation to support value of Stored Materials reported on APPLICATION AND CERTIFICATE FOR PAYMENT.

Page ____ of ____

PROGRESS SCHEDULE & REPORT		CONTRACTOR: (Contractor may use own form in lieu of Form C-11)	DATE OF REPORT:
PROJECT:		ARCHITECT:	PROCEED DATE:
DCM (BC) No.:			PROJECTED COMPLETION DATE:

WORK DIVISION	%	AMOUNT																			
1. GENERAL REQUIREMENTS																					
2. SITEWORK																					
3. CONCRETE																					
4. MASONRY																					
5. METALS																					
6. WOOD AND PLASTIC																					100%
7. THERMAL AND MOISTURE PROTECTION																					90%
8. DOORS AND WINDOWS																					80%
9. FINISHES																					70%
10. SPECIALTIES																					60%
11. EQUIPMENT																					50%
12. FURNISHINGS																					40%
13. SPECIAL CONSTRUCTION																					30%
14. CONVEYING SYSTEMS																					20%
15. MECHANICAL																					10%
16. ELECTRICAL																					0%
TOTAL ORIG. CONTRACT	100%																				
ANTICIPATED DRAW IN \$1,000																					
ACTUAL DRAW IN \$1,000																					


LEGEND: ANTICIPATED ACTIVITY ACTUAL ACTIVITY ANTICIPATED CASH FLOW ACTUAL CASH FLOW

USE ADDITIONAL SHEETS IF JOB IS SCHEDULED MORE THAN 12 MONTHS



AIA®

Document G701® – 2017

Change Order

PROJECT: *(Name and address)*
 CALHOUN COUNTY JAIL
 ADDITIONS & RENOVATIONS
 MENTAL HEALTH / MEDICAL UNIT
 ANNISTON, ALABAMA

CONTRACT INFORMATION:
 Contract For: Detention Module Package

CHANGE ORDER INFORMATION:
 Change Order Number:

OWNER: *(Name and address)*
 Calhoun County Commission
 1702 Noble Street, Suite 103
 Anniston, Alabama 36201»
 «Telephone Number: 256-241-2800»
 «Fax Number: 256-231-1744

Date:
ARCHITECT: *(Name and address)*
 JMR+H Architecture, PC
 445 Dexter Avenue, Suite 5050
 Montgomery, Alabama 36104

Date:
CONTRACTOR: *(Name and address)*

Jay Jenkins
 Associate Architect
 Jay Jenkins Architecture
 301 Buckner Circle
 Anniston, Alabama 36205

THE CONTRACT IS CHANGED AS FOLLOWS:

(Insert a detailed description of the change and, if applicable, attach or reference specific exhibits. Also include agreed upon adjustments attributable to executed Construction Change Directives.)

The original Contract Sum was	\$	0.00
The net change by previously authorized Change Orders	\$	0.00
The Contract Sum prior to this Change Order was	\$	0.00
The Contract Sum will be increased by this Change Order in the amount of	\$	0.00
The new Contract Sum including this Change Order will be	\$	0.00
The Contract Time will be increased by Zero (0) days.		
The new date of Substantial Completion will be		

NOTE: This Change Order does not include adjustments to the Contract Sum or Guaranteed Maximum Price, or the Contract Time, that have been authorized by Construction Change Directive until the cost and time have been agreed upon by both the Owner and Contractor, in which case a Change Order is executed to supersede the Construction Change Directive.

NOT VALID UNTIL SIGNED BY THE ARCHITECT, CONTRACTOR AND OWNER.

JMR+H Architecture, PC
 ARCHITECT *(Firm name)*

CONTRACTOR *(Firm name)*

OWNER *(Firm name)*

SIGNATURE

SIGNATURE

SIGNATURE

Mike Rutland, AIA, President
 PRINTED NAME AND TITLE

PRINTED NAME AND TITLE

PRINTED NAME AND TITLE

DATE

DATE

DATE

FORM OF ADVERTISEMENT FOR COMPLETION

LEGAL NOTICE

In accordance with Chapter 1, Title 39, Code of Alabama, 1975, as amended, notice is hereby given

that _____,
(Contractor Company Name)

Contractor, has completed the Contract for (Construction) (Renovation) (Alteration)
 (Equipment) (Improvement) of _____
(Name of Project):

at _____,
(Insert location data in County or City)

for the State of Alabama and the (County) (City) of _____,
Owner(s), and have made request for final settlement of said Contract. All persons having
any claim for labor, materials, or otherwise in connection with this project should immediately
notify

(Architect)

(Contractor)

(Business Address)

NOTE: This notice must be run once a week for four successive weeks for projects of \$50,000.00 or more. For projects of less than \$50,000.00, run one time only. A copy of the advertisement and publisher's affidavit of publication shall be submitted by the Contractor to the Design Professional for inclusion with DCM Form B-13: Final Payment Checklist for state agencies, PSCA-funded and other bond-funded projects.



AIA® Document G704® – 2017

Certificate of Substantial Completion

PROJECT: <i>(name and address)</i> CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS MENTAL HEALTH / MEDICAL UNIT ANNISTON, ALABAMA	CONTRACT INFORMATION: Contract For: Detention Module Package Date:	CERTIFICATE INFORMATION: Certificate Number: Date:
OWNER: <i>(name and address)</i> Calhoun County Commission 1702 Noble Street, Suite 103 Anniston, Alabama 36201	ARCHITECT: <i>(name and address)</i> JMR+H Architecture, PC 445 Dexter Avenue, Suite 5050 Montgomery, Alabama 36104	CONTRACTOR: <i>(name and address)</i>

The Work identified below has been reviewed and found, to the Architect's best knowledge, information, and belief, to be substantially complete. Substantial Completion is the stage in the progress of the Work when the Work or designated portion is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. The date of Substantial Completion of the Project or portion designated below is the date established by this Certificate. *(Identify the Work, or portion thereof, that is substantially complete.)*

JMR+H Architecture, PC ARCHITECT <i>(Firm Name)</i>	_____ SIGNATURE	Mike Rutland, AIA, President _____ PRINTED NAME AND TITLE	_____ DATE OF SUBSTANTIAL COMPLETION
---	---------------------------	---	--

WARRANTIES
The date of Substantial Completion of the Project or portion designated above is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below: *(Identify warranties that do not commence on the date of Substantial Completion, if any, and indicate their date of commencement.)*

WORK TO BE COMPLETED OR CORRECTED
A list of items to be completed or corrected is attached hereto, or transmitted as agreed upon by the parties, and identified as follows: *(Identify the list of Work to be completed or corrected.)*

The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Unless otherwise agreed to in writing, the date of commencement of warranties for items on the attached list will be the date of issuance of the final Certificate of Payment or the date of final payment, whichever occurs first. The Contractor will complete or correct the Work on the list of items attached hereto within () days from the above date of Substantial Completion.

Cost estimate of Work to be completed or corrected: \$

The responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work, insurance, and other items identified below shall be as follows: *(Note: Owner's and Contractor's legal and insurance counsel should review insurance requirements and coverage.)*

The Owner and Contractor hereby accept the responsibilities assigned to them in this Certificate of Substantial Completion:

_____ CONTRACTOR <i>(Firm Name)</i> Calhoun County Commission	_____ SIGNATURE	_____ PRINTED NAME AND TITLE	_____ DATE
_____ OWNER <i>(Firm Name)</i>	_____ SIGNATURE	_____ PRINTED NAME AND TITLE	_____ DATE



AIA® Document G706® – 1994

Contractor's Affidavit of Payment of Debts and Claims

PROJECT: *(Name and address)*

Calhoun County Jail Additions and Renovations
Mental Health / Medical Unit
Anniston, Alabama

ARCHITECT'S PROJECT NUMBER:

OWNER:

ARCHITECT:

CONTRACTOR:

SURETY:

OTHER:

TO OWNER: *(Name and address)*

Calhoun County Commission 1702
Noble Street, Suite 103
Anniston, Alabama 36201

CONTRACT FOR: Detention Module

CONTRACT DATED:

STATE OF:

COUNTY OF:

The undersigned hereby certifies that, except as listed below, payment has been made in full and all obligations have otherwise been satisfied for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced above for which the Owner or Owner's property might in any way be held responsible or encumbered.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Consent of Surety to Final Payment. Whenever Surety is involved, Consent of Surety is required. AIA Document G707, Consent of Surety, may be used for this purpose

Indicate Attachment Yes No

CONTRACTOR: *(Name and address)*

BY: _____

(Signature of authorized representative)

(Printed name and title)

The following supporting documents should be attached hereto if required by the Owner:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.
3. Contractor's Affidavit of Release of Liens (AIA Document G706A).

Subscribed and sworn to before me on this date:

Notary Public:

My Commission Expires:



AIA[®]

Document G706[®]A – 1994

Contractor's Affidavit of Release of Liens

PROJECT: *(Name and address)*

Calhoun County Jail Additions and Renovations

Mental Health / Medical Unit

Anniston, Alabama

TO OWNER: *(Name and address)*

Calhoun County Commission
1702 Noble Street, Suite 103

Anniston, Alabama 36201

ARCHITECT'S PROJECT NUMBER:

CONTRACT FOR: Detention Module

CONTRACT DATED:

OWNER:

ARCHITECT:

CONTRACTOR:

SURETY:

OTHER:

STATE OF:

COUNTY OF:

The undersigned hereby certifies that to the best of the undersigned's knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens or encumbrances or the right to assert liens or encumbrances against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

CONTRACTOR: *(Name and address)*

BY:

(Signature of authorized representative)

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:

My Commission Expires:



AIA[®] Document G707™ – 1994

Consent Of Surety to Final Payment

PROJECT: *(Name and address)*
Calhoun County Jail Additions and
Renovations
Mental Health / Medical Unit
Anniston, Alabama

ARCHITECT'S PROJECT NUMBER:

OWNER:

ARCHITECT:

CONTRACTOR:

SURETY:

OTHER:

TO OWNER: *(Name and address)*
Calhoun County Commission 1702
Noble Street, Suite 103 Anniston,
Alabama 36201

CONTRACT FOR: Detention Module Package

CONTRACT DATED:

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the
(Insert name and address of Surety)

on bond of
(Insert name and address of Contractor)

, SURETY,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall
not relieve the Surety of any of its obligations to
(Insert name and address of Owner)

, CONTRACTOR,

as set forth in said Surety's bond.

, OWNER,

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:
(Insert in writing the month followed by the numeric date and year.)

(Surety)

(Signature of authorized representative)

(Printed name and title)

Attest:
(Seal):



AIA® Document A201® – 2017

General Conditions of the Contract for Construction

for the following PROJECT:

(Name and location or address)

CALHOUN COUNTY JAIL
ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

THE OWNER:

(Name, legal status and address)

Calhoun County Commission
1702 Noble Street, Suite 103 Anniston,
Alabama 36201
Telephone Number: 256-241-2800 Fax
Number: 256-231-1744

THE ARCHITECT:

(Name, legal status and address)

JMR+H Architecture, PC
445 Dexter Avenue
Suite 5050
Montgomery, Alabama 36104
Telephone Number: 334-420-5672 Fax
Number: 334-420-5692

Jay Jenkins
Associate Architect
Jay Jenkins Architecture
301 Buckner Circle
Anniston, Alabama 36205

TABLE OF ARTICLES

- 1 GENERAL PROVISIONS
- 2 OWNER
- 3 CONTRACTOR
- 4 ARCHITECT
- 5 SUBCONTRACTORS
- 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

ADDITIONS AND DELETIONS:

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

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User Notes:

(1280650058)

7	CHANGES IN THE WORK
8	TIME
9	PAYMENTS AND COMPLETION
10	PROTECTION OF PERSONS AND PROPERTY
11	INSURANCE AND BONDS
12	UNCOVERING AND CORRECTION OF WORK
13	MISCELLANEOUS PROVISIONS
14	TERMINATION OR SUSPENSION OF THE CONTRACT
15	CLAIMS AND DISPUTES



INDEX

(Topics and numbers in bold are Section headings.)

Acceptance of Nonconforming Work

9.6.6, 9.9.3, **12.3**

Acceptance of Work

9.6.6, 9.8.2, 9.9.3, 9.10.1, 9.10.3, 12.3

Access to Work

3.16, 6.2.1, 12.1

Accident Prevention

10

Acts and Omissions

3.2, 3.3.2, 3.12.8, 3.18, 4.2.3, 8.3.1, 9.5.1, 10.2.5,

10.2.8, 13.3.2, 14.1, 15.1.2, 15.2

Addenda

1.1.1

Additional Costs, Claims for

3.7.4, 3.7.5, 10.3.2, 15.1.5

Additional Inspections and Testing

9.4.2, 9.8.3, 12.2.1, **13.4**

Additional Time, Claims for

3.2.4, 3.7.4, 3.7.5, 3.10.2, 8.3.2, **15.1.6**

Administration of the Contract

3.1.3, **4.2**, 9.4, 9.5

Advertisement or Invitation to Bid

1.1.1

Aesthetic Effect

4.2.13

Allowances

3.8

Applications for Payment

4.2.5, 7.3.9, 9.2, **9.3**, 9.4, 9.5.1, 9.5.4, 9.6.3, 9.7, 9.10

Approvals

2.1.1, 2.3.1, 2.5, 3.1.3, 3.10.2, 3.12.8, 3.12.9,

3.12.10.1, 4.2.7, 9.3.2, 13.4.1

Arbitration

8.3.1, 15.3.2, **15.4**

ARCHITECT

4

Architect, Definition of

4.1.1

Architect, Extent of Authority

2.5, 3.12.7, 4.1.2, 4.2, 5.2, 6.3, 7.1.2, 7.3.4, 7.4, 9.2,
9.3.1, 9.4, 9.5, 9.6.3, 9.8, 9.10.1, 9.10.3, 12.1, 12.2.1,
13.4.1, 13.4.2, 14.2.2, 14.2.4, 15.1.4, 15.2.1

Architect, Limitations of Authority and Responsibility

2.1.1, 3.12.4, 3.12.8, 3.12.10, 4.1.2, 4.2.1, 4.2.2, 4.2.3,
4.2.6, 4.2.7, 4.2.10, 4.2.12, 4.2.13, 5.2.1, 7.4, 9.4.2,
9.5.4, 9.6.4, 15.1.4, 15.2

Architect's Additional Services and Expenses

2.5, 12.2.1, 13.4.2, 13.4.3, 14.2.4

Architect's Administration of the Contract

3.1.3, 3.7.4, 15.2, 9.4.1, 9.5

Architect's Approvals

2.5, 3.1.3, 3.5, 3.10.2, 4.2.7

Architect's Authority to Reject Work

3.5, 4.2.6, 12.1.2, 12.2.1

Architect's Copyright

1.1.7, 1.5

Architect's Decisions

3.7.4, 4.2.6, 4.2.7, 4.2.11, 4.2.12, 4.2.13, 4.2.14, 6.3,
7.3.4, 7.3.9, 8.1.3, 8.3.1, 9.2, 9.4.1, 9.5, 9.8.4, 9.9.1,
13.4.2, 15.2

Architect's Inspections

3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.8.3, 9.9.2, 9.10.1, 13.4

Architect's Instructions

3.2.4, 3.3.1, 4.2.6, 4.2.7, 13.4.2

Architect's Interpretations

4.2.11, 4.2.12

Architect's Project Representative

4.2.10

Architect's Relationship with Contractor

1.1.2, 1.5, 2.3.3, 3.1.3, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2,
3.5, 3.7.4, 3.7.5, 3.9.2, 3.9.3, 3.10, 3.11, 3.12, 3.16,
3.18, 4.1.2, 4.2, 5.2, 6.2.2, 7, 8.3.1, 9.2, 9.3, 9.4, 9.5,
9.7, 9.8, 9.9, 10.2.6, 10.3, 11.3, 12, 13.3.2, 13.4, 15.2

Architect's Relationship with Subcontractors

1.1.2, 4.2.3, 4.2.4, 4.2.6, 9.6.3, 9.6.4, 11.3

Architect's Representations

9.4.2, 9.5.1, 9.10.1

Architect's Site Visits

3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.5.1, 9.9.2, 9.10.1, 13.4

Asbestos

10.3.1

Attorneys' Fees

3.18.1, 9.6.8, 9.10.2, 10.3.3

Award of Separate Contracts

6.1.1, 6.1.2

Award of Subcontracts and Other Contracts for Portions of the Work

5.2

Basic Definitions

1.1

Bidding Requirements

1.1.1

Binding Dispute Resolution

8.3.1, 9.7, 11.5, 13.1, 15.1.2, 15.1.3, 15.2.1, 15.2.5,
15.2.6.1, 15.3.1, 15.3.2, 15.3.3, 15.4.1

Bonds, Lien

7.3.4.4, 9.6.8, 9.10.2, 9.10.3

Bonds, Performance, and Payment

7.3.4.4, 9.6.7, 9.10.3, **11.1.2**, 11.1.3, **11.5**

Building Information Models Use and Reliance

1.8

Building Permit

3.7.1

Capitalization

1.3

Certificate of Substantial Completion

9.8.3, 9.8.4, 9.8.5

Init.

/

Certificates for Payment

4.2.1, 4.2.5, 4.2.9, 9.3.3, **9.4**, 9.5, 9.6.1, 9.6.6, 9.7, 9.10.1, 9.10.3, 14.1.1.3, 14.2.4, 15.1.4

Certificates of Inspection, Testing or Approval
13.4.4

Certificates of Insurance
9.10.2

Change Orders

1.1.1, 3.4.2, 3.7.4, 3.8.2.3, 3.11, 3.12.8, 4.2.8, 5.2.3, 7.1.2, 7.1.3, **7.2**, 7.3.2, 7.3.7, 7.3.9, 7.3.10, 8.3.1, 9.3.1.1, 9.10.3, 10.3.2, 11.2, 11.5, 12.1.2

Change Orders, Definition of

7.2.1

CHANGES IN THE WORK

2.2.2, 3.11, 4.2.8, **7**, 7.2.1, 7.3.1, 7.4, 8.3.1, 9.3.1.1, 11.5

Claims, Definition of

15.1.1

Claims, Notice of
1.6.2, 15.1.3

CLAIMS AND DISPUTES

3.2.4, 6.1.1, 6.3, 7.3.9, 9.3.3, 9.10.4, 10.3.3, **15**, 15.4
Claims and Timely Assertion of Claims
15.4.1

Claims for Additional Cost

3.2.4, 3.3.1, 3.7.4, 7.3.9, 9.5.2, 10.2.5, 10.3.2, **15.1.5**

Claims for Additional Time

3.2.4, 3.3.1, 3.7.4, 6.1.1, 8.3.2, 9.5.2, 10.3.2, **15.1.6**

Concealed or Unknown Conditions, Claims for

3.7.4

Claims for Damages
3.2.4, 3.18, 8.3.3, 9.5.1, 9.6.7, 10.2.5, 10.3.3, 11.3, 11.3.2, 14.2.4, 15.1.7

Claims Subject to Arbitration
15.4.1

Cleaning Up

3.15, 6.3

Commencement of the Work, Conditions Relating to
2.2.1, 3.2.2, 3.4.1, 3.7.1, 3.10.1, 3.12.6, 5.2.1, 5.2.3, 6.2.2, 8.1.2, 8.2.2, 8.3.1, 11.1, 11.2, **15.1.5**

Commencement of the Work, Definition of

8.1.2

Communications

3.9.1, **4.2.4**
Completion, Conditions Relating to
3.4.1, 3.11, 3.15, 4.2.2, 4.2.9, 8.2, 9.4.2, 9.8, 9.9.1, 9.10, 12.2, 14.1.2, 15.1.2

COMPLETION, PAYMENTS AND

9

Completion, Substantial
3.10.1, 4.2.9, 8.1.1, 8.1.3, 8.2.3, 9.4.2, 9.8, 9.9.1, 9.10.3, 12.2, 15.1.2
Compliance with Laws
2.3.2, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 9.6.4, 10.2.2, 13.1, 13.3, 13.4.1, 13.4.2, 13.5, 14.1.1, 14.2.1.3, 15.2.8, 15.4.2, 15.4.3

Concealed or Unknown Conditions

3.7.4, 4.2.8, 8.3.1, 10.3

Conditions of the Contract

1.1.1, 6.1.1, 6.1.4

Consent, Written

3.4.2, 3.14.2, 4.1.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3, 13.2, 15.4.4.2

Consolidation or Joinder

15.4.4

CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

1.1.4, **6**

Construction Change Directive, Definition of

7.3.1

Construction Change Directives

1.1.1, 3.4.2, 3.11, 3.12.8, 4.2.8, 7.1.1, 7.1.2, 7.1.3, **7.3**, 9.3.1.1

Construction Schedules, Contractor's

3.10, 3.11, 3.12.1, 3.12.2, 6.1.3, 15.1.6.2

Contingent Assignment of Subcontracts

5.4, 14.2.2.2

Continuing Contract Performance

15.1.4

Contract, Definition of

1.1.2

CONTRACT, TERMINATION OR SUSPENSION OF THE

5.4.1.1, 5.4.2, 11.5, **14**

Contract Administration

3.1.3, 4, 9.4, 9.5

Contract Award and Execution, Conditions Relating to

3.7.1, 3.10, 5.2, 6.1

Contract Documents, Copies Furnished and Use of
1.5.2, 2.3.6, 5.3

Contract Documents, Definition of

1.1.1

Contract Sum

2.2.2, 2.2.4, 3.7.4, 3.7.5, 3.8, 3.10.2, 5.2.3, 7.3, 7.4, **9.1**, 9.2, 9.4.2, 9.5.1.4, 9.6.7, 9.7, 10.3.2, 11.5, 12.1.2, 12.3, 14.2.4, 14.3.2, 15.1.4.2, **15.1.5**, **15.2.5**

Contract Sum, Definition of

9.1

Contract Time

1.1.4, 2.2.1, 2.2.2, 3.7.4, 3.7.5, 3.10.2, 5.2.3, 6.1.5, 7.2.1.3, 7.3.1, 7.3.5, 7.3.6, 7, 7, 7.3.10, 7.4, 8.1.1, 8.2.1, 8.2.3, 8.3.1, 9.5.1, 9.7, 10.3.2, 12.1.1, 12.1.2, 14.3.2, 15.1.4.2, 15.1.6.1, 15.2.5

Contract Time, Definition of

8.1.1

CONTRACTOR

3

Contractor, Definition of

3.1, **6.1.2**

Contractor's Construction and Submittal Schedules

3.10, 3.12.1, 3.12.2, 4.2.3, 6.1.3, 15.1.6.2

Contractor's Employees
2.2.4, 3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2,
10.3, 11.3, 14.1, 14.2.1.1

Contractor's Liability Insurance

11.1

Contractor's Relationship with Separate Contractors
and Owner's Forces

3.12.5, 3.14.2, 4.2.4, 6, 11.3, 12.2.4

Contractor's Relationship with Subcontractors

1.2.2, 2.2.4, 3.3.2, 3.18.1, 3.18.2, 4.2.4, 5, 9.6.2, 9.6.7,
9.10.2, 11.2, 11.3, 11.4

Contractor's Relationship with the Architect

1.1.2, 1.5, 2.3.3, 3.1.3, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2,
3.5.1, 3.7.4, 3.10, 3.11, 3.12, 3.16, 3.18, 4.2, 5.2, 6.2.2,
7, 8.3.1, 9.2, 9.3, 9.4, 9.5, 9.7, 9.8, 9.9, 10.2.6, 10.3,
11.3, 12, 13.4, 15.1.3, 15.2.1

Contractor's Representations

3.2.1, 3.2.2, 3.5, 3.12.6, 6.2.2, 8.2.1, 9.3.3, 9.8.2

Contractor's Responsibility for Those Performing the
Work

3.3.2, 3.18, 5.3, 6.1.3, 6.2, 9.5.1, 10.2.8

Contractor's Review of Contract Documents

3.2

Contractor's Right to Stop the Work

2.2.2, 9.7

Contractor's Right to Terminate the Contract

14.1

Contractor's Submittals

3.10, 3.11, 3.12, 4.2.7, 5.2.1, 5.2.3, 9.2, 9.3, 9.8.2,
9.8.3, 9.9.1, 9.10.2, 9.10.3

Contractor's Superintendent

3.9, 10.2.6

Contractor's Supervision and Construction

Procedures

1.2.2, 3.3, 3.4, 3.12.10, 4.2.2, 4.2.7, 6.1.3, 6.2.4, 7.1.3,
7.3.4, 7.3.6, 8.2, 10, 12, 14, 15.1.4

Coordination and Correlation

1.2, 3.2.1, 3.3.1, 3.10, 3.12.6, 6.1.3, 6.2.1

Copies Furnished of Drawings and Specifications

1.5, 2.3.6, 3.11

Copyrights

1.5, **3.17**

Correction of Work

2.5, 3.7.3, 9.4.2, 9.8.2, 9.8.3, 9.9.1, 12.1.2, **12.2**, 12.3,
15.1.3.1, 15.1.3.2, 15.2.1

Correlation and Intent of the Contract Documents

1.2

Cost, Definition of

7.3.4

Costs

2.5, 3.2.4, 3.7.3, 3.8.2, 3.15.2, 5.4.2, 6.1.1, 6.2.3,
7.3.3.3, 7.3.4, 7.3.8, 7.3.9, 9.10.2, 10.3.2, 10.3.6, 11.2,
12.1.2, 12.2.1, 12.2.4, 13.4, 14

Cutting and Patching

3.14, 6.2.5

Damage to Construction of Owner or Separate
Contractors

3.14.2, 6.2.4, 10.2.1.2, 10.2.5, 10.4, 12.2.4

Damage to the Work

3.14.2, 9.9.1, 10.2.1.2, 10.2.5, 10.4, 12.2.4

Damages, Claims for

3.2.4, 3.18, 6.1.1, 8.3.3, 9.5.1, 9.6.7, 10.3.3, 11.3.2,
11.3, 14.2.4, 15.1.7

Damages for Delay

6.2.3, 8.3.3, 9.5.1.6, 9.7, 10.3.2, 14.3.2

Date of Commencement of the Work, Definition of

8.1.2

Date of Substantial Completion, Definition of

8.1.3

Day, Definition of

8.1.4

Decisions of the Architect

3.7.4, 4.2.6, 4.2.7, 4.2.11, 4.2.12, 4.2.13, 6.3, 7.3.4,
7.3.9, 8.1.3, 8.3.1, 9.2, 9.4, 9.5.1, 9.8.4, 9.9.1, 13.4.2,
14.2.2, 14.2.4, 15.1, 15.2

Decisions to Withhold Certification

9.4.1, **9.5**, 9.7, 14.1.1.3

Defective or Nonconforming Work, Acceptance,
Rejection and Correction of

2.5, 3.5, 4.2.6, 6.2.3, 9.5.1, 9.5.3, 9.6.6, 9.8.2, 9.9.3,
9.10.4, 12.2.1

Definitions

1.1, 2.1.1, 3.1.1, 3.5, 3.12.1, 3.12.2, 3.12.3, 4.1.1, 5.1,
6.1.2, 7.2.1, 7.3.1, 8.1, 9.1, 9.8.1, 15.1.1

Delays and Extensions of Time

3.2, **3.7.4**, 5.2.3, 7.2.1, 7.3.1, **7.4**, **8.3**, 9.5.1, **9.7**,
10.3.2, **10.4**, 14.3.2, **15.1.6**, 15.2.5

Digital Data Use and Transmission

1.7

Disputes

6.3, 7.3.9, 15.1, 15.2

Documents and Samples at the Site

3.11

Drawings, Definition of

1.1.5

Drawings and Specifications, Use and Ownership of

3.11

Effective Date of Insurance

8.2.2

Emergencies

10.4, 14.1.1.2, **15.1.5**

Employees, Contractor's

3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2,
10.3.3, 11.3, 14.1, 14.2.1.1

Equipment, Labor, or Materials

1.1.3, 1.1.6, 3.4, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1,
4.2.6, 4.2.7, 5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3,
9.10.2, 10.2.1, 10.2.4, 14.2.1.1, 14.2.1.2

Execution and Progress of the Work

1.1.3, 1.2.1, 1.2.2, 2.3.4, 2.3.6, 3.1, 3.3.1, 3.4.1, 3.7.1,
3.10.1, 3.12, 3.14, 4.2, 6.2.2, 7.1.3, 7.3.6, 8.2, 9.5.1,
9.9.1, 10.2, 10.3, 12.1, 12.2, 14.2, 14.3.1, 15.1.4

Extensions of Time
3.2.4, 3.7.4, 5.2.3, 7.2.1, 7.3, 7.4, 9.5.1, 9.7, 10.3.2,
10.4, 14.3, 15.1.6, **15.2.5**

Failure of Payment

9.5.1.3, **9.7**, 9.10.2, 13.5, 14.1.1.3, 14.2.1.2

Faulty Work

(See Defective or Nonconforming Work)

Final Completion and Final Payment

4.2.1, 4.2.9, 9.8.2, **9.10**, 12.3, 14.2.4, 14.4.3

Financial Arrangements, Owner's

2.2.1, 13.2.2, 14.1.1.4

GENERAL PROVISIONS

1

Governing Law

13.1

Guarantees (See Warranty)

Hazardous Materials and Substances

10.2.4, **10.3**

Identification of Subcontractors and Suppliers

5.2.1

Indemnification

3.17, **3.18**, 9.6.8, 9.10.2, 10.3.3, 11.3

Information and Services Required of the Owner

2.1.2, **2.2**, 2.3, 3.2.2, 3.12.10.1, 6.1.3, 6.1.4, 6.2.5,
9.6.1, 9.9.2, 9.10.3, 10.3.3, 11.2, 13.4.1, 13.4.2,
14.1.1.4, 14.1.4, 15.1.4

Initial Decision

15.2

Initial Decision Maker, Definition of

1.1.8

Initial Decision Maker, Decisions

14.2.4, 15.1.4.2, 15.2.1, 15.2.2, 15.2.3, 15.2.4, 15.2.5

Initial Decision Maker, Extent of Authority

14.2.4, 15.1.4.2, 15.2.1, 15.2.2, 15.2.3, 15.2.4, 15.2.5

Injury or Damage to Person or Property

10.2.8, 10.4

Inspections

3.1.3, 3.3.3, 3.7.1, 4.2.2, 4.2.6, 4.2.9, 9.4.2, 9.8.3,
9.9.2, 9.10.1, 12.2.1, 13.4

Instructions to Bidders

1.1.1

Instructions to the Contractor

3.2.4, 3.3.1, 3.8.1, 5.2.1, 7, 8.2.2, 12, 13.4.2

Instruments of Service, Definition of

1.1.7

Insurance

6.1.1, 7.3.4, 8.2.2, 9.3.2, 9.8.4, 9.9.1, 9.10.2, 10.2.5, **11**

Insurance, Notice of Cancellation or Expiration

11.1.4, 11.2.3

Insurance, Contractor's Liability

11.1

Insurance, Effective Date of
8.2.2, 14.4.2

Insurance, Owner's Liability

11.2

Insurance, Property

10.2.5, 11.2, 11.4, 11.5

Insurance, Stored Materials

9.3.2

INSURANCE AND BONDS

11

Insurance Companies, Consent to Partial Occupancy

9.9.1

Insured loss, Adjustment and Settlement of

11.5

Intent of the Contract Documents

1.2.1, 4.2.7, 4.2.12, 4.2.13

Interest

13.5

Interpretation

1.1.8, 1.2.3, **1.4**, 4.1.1, 5.1, 6.1.2, 15.1.1

Interpretations, Written

4.2.11, 4.2.12

Judgment on Final Award

15.4.2

Labor and Materials, Equipment

1.1.3, 1.1.6, **3.4**, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1,
5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2, 10.2.1,
10.2.4, 14.2.1.1, 14.2.1.2

Labor Disputes

8.3.1

Laws and Regulations

1.5, 2.3.2, 3.2.3, 3.2.4, 3.6, 3.7, 3.12.10, 3.13, 9.6.4,
9.9.1, 10.2.2, 13.1, 13.3.1, 13.4.2, 13.5, 14, 15.2.8,
15.4

Liens

2.1.2, 9.3.1, 9.3.3, 9.6.8, 9.10.2, 9.10.4, 15.2.8

Limitations, Statutes of

12.2.5, 15.1.2, 15.4.1.1

Limitations of Liability

3.2.2, 3.5, 3.12.10, 3.12.10.1, 3.17, 3.18.1, 4.2.6,
4.2.7, 6.2.2, 9.4.2, 9.6.4, 9.6.7, 9.6.8, 10.2.5, 10.3.3,
11.3, 12.2.5, 13.3.1

Limitations of Time

2.1.2, 2.2, 2.5, 3.2.2, 3.10, 3.11, 3.12.5, 3.15.1, 4.2.7,
5.2, 5.3, 5.4.1, 6.2.4, 7.3, 7.4, 8.2, 9.2, 9.3.1, 9.3.3,
9.4.1, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 12.2, 13.4, 14, 15,
15.1.2, 15.1.3, 15.1.5

Materials, Hazardous

10.2.4, **10.3**

Materials, Labor, Equipment and

1.1.3, 1.1.6, 3.4.1, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1,
5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2,
10.2.1.2, 10.2.4, 14.2.1.1, 14.2.1.2

Means, Methods, Techniques, Sequences and Procedures of Construction

3.3.1, 3.12.10, 4.2.2, 4.2.7, 9.4.2

Mechanic's Lien

2.1.2, 9.3.1, 9.3.3, 9.6.8, 9.10.2, 9.10.4, 15.2.8

Mediation

8.3.1, 15.1.3.2, 15.2.1, 15.2.5, 15.2.6, **15.3**, 15.4.1,
15.4.1.1

Minor Changes in the Work

1.1.1, 3.4.2, 3.12.8, 4.2.8, 7.1, **7.4**

MISCELLANEOUS PROVISIONS

13

Modifications, Definition of

1.1.1

Modifications to the Contract

1.1.1, 1.1.2, 2.5, 3.11, 4.1.2, 4.2.1, 5.2.3, 7, 8.3.1, 9.7, 10.3.2

Mutual Responsibility

6.2

Nonconforming Work, Acceptance of

9.6.6, 9.9.3, **12.3**

Nonconforming Work, Rejection and Correction of
2.4, 2.5, 3.5, 4.2.6, 6.2.4, 9.5.1, 9.8.2, 9.9.3, 9.10.4, 12.2

Notice

1.6, 1.6.1, 1.6.2, 2.1.2, 2.2.2., 2.2.3, 2.2.4, 2.5, 3.2.4, 3.3.1, 3.7.4, 3.7.5, 3.9.2, 3.12.9, 3.12.10, 5.2.1, 7.4, 8.2.2, 9.6.8, 9.7, 9.10.1, 10.2.8, 10.3.2, 11.5, 12.2.2.1, 13.4.1, 13.4.2, 14.1, 14.2.2, 14.4.2, 15.1.3, 15.1.5, 15.1.6, 15.4.1

Notice of Cancellation or Expiration of Insurance

11.1.4, 11.2.3

Notice of Claims

1.6.2, 2.1.2, 3.7.4, 9.6.8, 10.2.8, **15.1.3**, 15.1.5, 15.1.6, 15.2.8, 15.3.2, 15.4.1

Notice of Testing and Inspections

13.4.1, 13.4.2

Observations, Contractor's

3.2, 3.7.4

Occupancy

2.3.1, 9.6.6, 9.8

Orders, Written

1.1.1, 2.4, 3.9.2, 7, 8.2.2, 11.5, 12.1, 12.2.2.1, 13.4.2, 14.3.1

OWNER

2

Owner, Definition of

2.1.1

Owner, Evidence of Financial Arrangements

2.2, 13.2.2, 14.1.1.4

Owner, Information and Services Required of the

2.1.2, **2.2**, 2.3, 3.2.2, 3.12.10, 6.1.3, 6.1.4, 6.2.5, 9.3.2, 9.6.1, 9.6.4, 9.9.2, 9.10.3, 10.3.3, 11.2, 13.4.1, 13.4.2, 14.1.1.4, 14.1.4, 15.1.4

Owner's Authority

1.5, 2.1.1, 2.3.32.4, 2.5, 3.4.2, 3.8.1, 3.12.10, 3.14.2, 4.1.2, 4.2.4, 4.2.9, 5.2.1, 5.2.4, 5.4.1, 6.1, 6.3, 7.2.1, 7.3.1, 8.2.2, 8.3.1, 9.3.2, 9.5.1, 9.6.4, 9.9.1, 9.10.2, 10.3.2, 11.4, 11.5, 12.2.2, 12.3, 13.2.2, 14.3, 14.4, 15.2.7

Owner's Insurance

11.2

Owner's Relationship with Subcontractors

1.1.2, 5.2, 5.3, 5.4, 9.6.4, 9.10.2, 14.2.2

Owner's Right to Carry Out the Work

2.5, 14.2.2

Owner's Right to Clean Up

6.3

Owner's Right to Perform Construction and to Award Separate Contracts

6.1

Owner's Right to Stop the Work

2.4

Owner's Right to Suspend the Work

14.3

Owner's Right to Terminate the Contract

14.2, 14.4

Ownership and Use of Drawings, Specifications and Other Instruments of Service

1.1.1, 1.1.6, 1.1.7, **1.5**, 2.3.6, 3.2.2, 3.11, 3.17, 4.2.12, 5.3

Partial Occupancy or Use

9.6.6, **9.9**

Patching, Cutting and

3.14, 6.2.5

Patents

3.17

Payment, Applications for

4.2.5, 7.3.9, 9.2, **9.3**, 9.4, 9.5, 9.6.3, 9.7, 9.8.5, 9.10.1, 14.2.3, 14.2.4, 14.4.3

Payment, Certificates for

4.2.5, 4.2.9, 9.3.3, **9.4**, 9.5, 9.6.1, 9.6.6, 9.7, 9.10.1, 9.10.3, 14.1.1.3, 14.2.4

Payment, Failure of

9.5.1.3, **9.7**, 9.10.2, 13.5, 14.1.1.3, 14.2.1.2

Payment, Final

4.2.1, 4.2.9, **9.10**, 12.3, 14.2.4, 14.4.3

Payment Bond, Performance Bond and

7.3.4.4, 9.6.7, 9.10.3, **11.1.2**

Payments, Progress

9.3, **9.6**, 9.8.5, 9.10.3, 14.2.3, 15.1.4

PAYMENTS AND COMPLETION

9

Payments to Subcontractors

5.4.2, 9.5.1.3, 9.6.2, 9.6.3, 9.6.4, 9.6.7, 14.2.1.2

PCB

10.3.1

Performance Bond and Payment Bond

7.3.4.4, 9.6.7, 9.10.3, **11.1.2**

Permits, Fees, Notices and Compliance with Laws

2.3.1, **3.7**, 3.13, 7.3.4.4, 10.2.2

PERSONS AND PROPERTY, PROTECTION OF

10

Polychlorinated Biphenyl

10.3.1

Product Data, Definition of

3.12.2

Product Data and Samples, Shop Drawings

3.11, **3.12**, 4.2.7

Progress and Completion

4.2.2, **8.2**, 9.8, 9.9.1, 14.1.4, 15.1.4

Progress Payments

9.3, **9.6**, 9.8.5, 9.10.3, 14.2.3, 15.1.4

Init.

/

Project, Definition of
1.1.4
Project Representatives
4.2.10
Property Insurance
10.2.5, **11.2**
Proposal Requirements
1.1.1
PROTECTION OF PERSONS AND PROPERTY
10
Regulations and Laws
1.5, 2.3.2, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 9.6.4, 9.9.1,
10.2.2, 13.1, 13.3, 13.4.1, 13.4.2, 13.5, 14, 15.2.8, 15.4
Rejection of Work
4.2.6, 12.2.1
Releases and Waivers of Liens
9.3.1, 9.10.2
Representations
3.2.1, 3.5, 3.12.6, 8.2.1, 9.3.3, 9.4.2, 9.5.1, 9.10.1
Representatives
2.1.1, 3.1.1, 3.9, 4.1.1, 4.2.10, 13.2.1
Responsibility for Those Performing the Work
3.3.2, 3.18, 4.2.2, 4.2.3, 5.3, 6.1.3, 6.2, 6.3, 9.5.1, 10
Retainage
9.3.1, 9.6.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3
Review of Contract Documents and Field
Conditions by Contractor
3.2, 3.12.7, 6.1.3
Review of Contractor's Submittals by Owner and
Architect
3.10.1, 3.10.2, 3.11, 3.12, 4.2, 5.2, 6.1.3, 9.2, 9.8.2
Review of Shop Drawings, Product Data and Samples
by Contractor
3.12
Rights and Remedies
1.1.2, 2.4, 2.5, 3.5, 3.7.4, 3.15.2, 4.2.6, 5.3, 5.4, 6.1,
6.3, 7.3.1, 8.3, 9.5.1, 9.7, 10.2.5, 10.3, 12.2.1, 12.2.2,
12.2.4, **13.3**, 14, 15.4
Royalties, Patents and Copyrights
3.17
Rules and Notices for Arbitration
15.4.1
Safety of Persons and Property
10.2, 10.4
Safety Precautions and Programs
3.3.1, 4.2.2, 4.2.7, 5.3, **10.1**, 10.2, 10.4
Samples, Definition of
3.12.3
Samples, Shop Drawings, Product Data and
3.11, **3.12**, 4.2.7
Samples at the Site, Documents and
3.11
Schedule of Values
9.2, 9.3.1
Schedules, Construction
3.10, 3.12.1, 3.12.2, 6.1.3, 15.1.6.2

Separate Contracts and Contractors
1.1.4, 3.12.5, 3.14.2, 4.2.4, 4.2.7, 6, 8.3.1, 12.1.2
Separate Contractors, Definition of
6.1.1
Shop Drawings, Definition of
3.12.1
Shop Drawings, Product Data and Samples
3.11, **3.12**, 4.2.7
Site, Use of
3.13, 6.1.1, 6.2.1
Site Inspections
3.2.2, 3.3.3, 3.7.1, 3.7.4, 4.2, 9.9.2, 9.4.2, 9.10.1, 13.4
Site Visits, Architect's
3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.5.1, 9.9.2, 9.10.1, 13.4
Special Inspections and Testing
4.2.6, 12.2.1, 13.4
Specifications, Definition of
1.1.6
Specifications
1.1.1, **1.1.6**, 1.2.2, 1.5, 3.12.10, 3.17, 4.2.14
Statute of Limitations
15.1.2, 15.4.1.1
Stopping the Work
2.2.2, 2.4, 9.7, 10.3, 14.1
Stored Materials
6.2.1, 9.3.2, 10.2.1.2, 10.2.4
Subcontractor, Definition of
5.1.1
SUBCONTRACTORS
5
Subcontractors, Work by
1.2.2, 3.3.2, 3.12.1, 3.18, 4.2.3, 5.2.3, 5.3, 5.4, 9.3.1.2,
9.6.7
Subcontractual Relations
5.3, 5.4, 9.3.1.2, 9.6, 9.10, 10.2.1, 14.1, 14.2.1
Submittals
3.10, 3.11, 3.12, 4.2.7, 5.2.1, 5.2.3, 7.3.4, 9.2, 9.3, 9.8,
9.9.1, 9.10.2, 9.10.3
Submittal Schedule
3.10.2, 3.12.5, 4.2.7
Subrogation, Waivers of
6.1.1, **11.3**
Substances, Hazardous
10.3
Substantial Completion
4.2.9, 8.1.1, 8.1.3, 8.2.3, 9.4.2, **9.8**, 9.9.1, 9.10.3, 12.2,
15.1.2
Substantial Completion, Definition of
9.8.1
Substitution of Subcontractors
5.2.3, 5.2.4
Substitution of Architect
2.3.3
Substitutions of Materials
3.4.2, 3.5, 7.3.8
Sub-subcontractor, Definition of
5.1.2

Subsurface Conditions
3.7.4

Successors and Assigns
13.2

Superintendent
3.9, 10.2.6

Supervision and Construction Procedures
1.2.2, **3.3**, 3.4, 3.12.10, 4.2.2, 4.2.7, 6.1.3, 6.2.4, 7.1.3,
7.3.4, 8.2, 8.3.1, 9.4.2, 10, 12, 14, 15.1.4

Suppliers
1.5, 3.12.1, 4.2.4, 4.2.6, 5.2.1, 9.3, 9.4.2, 9.5.4, 9.6,
9.10.5, 14.2.1

Surety
5.4.1.2, 9.6.8, 9.8.5, 9.10.2, 9.10.3, 11.1.2, 14.2.2,
15.2.7

Surety, Consent of
9.8.5, 9.10.2, 9.10.3

Surveys
1.1.7, 2.3.4

Suspension by the Owner for Convenience
14.3

Suspension of the Work
3.7.5, 5.4.2, 14.3

Suspension or Termination of the Contract
5.4.1.1, 14

Taxes
3.6, 3.8.2.1, 7.3.4.4

Termination by the Contractor
14.1, 15.1.7

Termination by the Owner for Cause
5.4.1.1, **14.2**, 15.1.7

Termination by the Owner for Convenience
14.4

Termination of the Architect
2.3.3

Termination of the Contractor Employment
14.2.2

**TERMINATION OR SUSPENSION OF THE
CONTRACT**

14

Tests and Inspections
3.1.3, 3.3.3, 3.7.1, 4.2.2, 4.2.6, 4.2.9, 9.4.2, 9.8.3,
9.9.2, 9.10.1, 10.3.2, 12.2.1, **13.4**

TIME
8

Time, Delays and Extensions of
3.2.4, 3.7.4, 5.2.3, 7.2.1, 7.3.1, 7.4, **8.3**, 9.5.1, 9.7,
10.3.2, 10.4, 14.3.2, 15.1.6, 15.2.5

Time Limits

2.1.2, 2.2, 2.5, 3.2.2, 3.10, 3.11, 3.12.5, 3.15.1, 4.2,
5.2, 5.3, 5.4, 6.2.4, 7.3, 7.4, 8.2, 9.2, 9.3.1, 9.3.3, 9.4.1,
9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 12.2, 13.4, 14, 15.1.2,
15.1.3, 15.4

Time Limits on Claims

3.7.4, 10.2.8, 15.1.2, 15.1.3

Title to Work

9.3.2, 9.3.3

UNCOVERING AND CORRECTION OF WORK
12

Uncovering of Work
12.1

Unforeseen Conditions, Concealed or Unknown
3.7.4, 8.3.1, 10.3

Unit Prices
7.3.3.2, 9.1.2

Use of Documents
1.1.1, 1.5, 2.3.6, 3.12.6, 5.3

Use of Site
3.13, 6.1.1, 6.2.1

Values, Schedule of
9.2, 9.3.1

Waiver of Claims by the Architect
13.3.2

Waiver of Claims by the Contractor
9.10.5, 13.3.2, **15.1.7**

Waiver of Claims by the Owner
9.9.3, 9.10.3, 9.10.4, 12.2.2.1, 13.3.2, 14.2.4, **15.1.7**

Waiver of Consequential Damages
14.2.4, 15.1.7

Waiver of Liens
9.3, 9.10.2, 9.10.4

Waivers of Subrogation
6.1.1, **11.3**

Warranty
3.5, 4.2.9, 9.3.3, 9.8.4, 9.9.1, 9.10.2, 9.10.4, 12.2.2,
15.1.2

Weather Delays
8.3, 15.1.6.2

Work, Definition of
1.1.3

Written Consent
1.5.2, 3.4.2, 3.7.4, 3.12.8, 3.14.2, 4.1.2, 9.3.2, 9.10.3,
13.2, 13.3.2, 15.4.4.2

Written Interpretations
4.2.11, 4.2.12

Written Orders
1.1.1, 2.4, 3.9, 7, 8.2.2, 12.1, 12.2, 13.4.2, 14.3.1

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document

G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- .1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- .3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and

delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will

specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

- .1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
- .2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
- .5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;

- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- .1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents;
- .3 terms of special warranties required by the Contract Documents; or
- .4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

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- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will

promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act

or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 **Failure to Purchase Required Property Insurance.** If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 **Notice of Cancellation or Expiration of Owner's Required Property Insurance.** Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

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The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and

approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.



EXHIBIT A.2

MINIMUM LEGAL REQUIREMENTS, INCLUDING RELEVANT ARPA TERMS AND CONDITIONS, APPLICABLE TO CONTRACTORS

The following terms and conditions must be built into any bid or resulting contract documents with any contractor engaged to perform work on the project:

Contractor must agree to the terms and conditions applicable to architects/engineers included in Exhibit A.1 above.

Section 41-16-5 of the Code of Alabama (1975) imposes conditions on the award of County contracts. Contractor must certify that it is not currently engaged in, and will not engage in, the boycott of a person or an entity based in or doing business with a jurisdiction with which this state can enjoy open trade.

Contractor must use strong labor standards, including payment of a competitive and prevailing wage in the County.

Contractor must adopt and follow high safety standards and provide training based upon the appropriate licensures, certifications, and industry standards.

Contractor should prioritize local hiring consistent with the racial, gender, geographic, urban, rural, and economic diversity of the County.

For contracts/subcontracts over \$100,000, work performed by mechanics and laborers are subject to the provisions of the Contract Work Hours and Safety Standards Act (40 USC 3702 and 3704), as supplemented by 29 C.F.R. Part 5, including, specifically, safety standards, limitations on hours in a work week and overtime for any work spent over 40 hours, and proper documentation for all employees.

(1) A Contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall not require or permit any laborer or mechanic, in any workweek in which the laborer or mechanic is employed on that work, to work more than 40 hours in that workweek, except as provided 40 USC Chapter 37; and

(2) when a violation of clause (1) occurs, the Contractor and any subcontractor responsible for the violation are liable—

(A) to the affected employee for the employee's unpaid wages; and

(B) to the Government, the District of Columbia, or a territory for liquidated damages as provided in the contract.

State of _____
County of _____

**CERTIFICATE OF COMPLIANCE WITH THE BEASON-HAMMON ALABAMA TAXPAYER AND CITIZEN PROTECTION ACT
(ACT 2011-535, as amended by ACT 2012-491)**

DATE: _____

RE: Contract/Grant/Incentive (describe by number or subject): _____ **by and between**
_____ **(Contractor/Grantee) and**
_____ **(State Agency, Department of Public Entity)**

The undersigned hereby certifies to the State of Alabama as follows:

1. The undersigned holds the position of _____ with the Contractor/Grantee named above, and is authorized to provide representations set out in this Certificate as the official and binding act of that entity, and has knowledge of the provisions of **THE BEASON-HAMMON ALABAMA TAXPAYER AND CITIZEN PROTECTION ACT** (ACT 2011-535 of the Alabama Legislature, as amended by Act 2012-491) which is described herein as "the Act".
2. Using the following definitions from Section 3 of the Act, select and initial either (a) or (b), below, to describe the Contractor/Grantee's business structure.

BUSINESS ENTITY: Any person or group of persons employing one or more persons performing or engaging in any activity, enterprise, profession, or occupation for gain, benefit, advantage, or livelihood, whether for profit or not for profit. "Business entity" shall include, but not be limited to the following:

- a. Self-employed individuals, business entities filing articles of incorporation, partnerships, limited partnerships, limited liability companies, foreign corporations, foreign limited partnerships, foreign limited liability companies authorized to transact business in this state, business trusts, and any business entity that registers with the Secretary of State.
- b. Any business entity that possesses a business license, permit, certificate, approval, registration, charter, or similar form of authorization issued by the state, any business entity that is exempt by law from obtaining such a business license and any business entity that is operating unlawfully without a business license.

EMPLOYER: Any person, firm, corporation, partnership, joint stock association, agent, manager, representative, foreman, or other person having control or custody of any employment, place of employment, or of any employee, including any person or entity employing any person for hire within the State of Alabama, including a public employer. This term shall not include the occupant of a household contracting with another person to perform casual domestic labor within the household.

___ (a) the Contractor/grantee is a business entity or employer as those terms are defined in Section 3 of the Act. The Contractor/Grantee must attach a copy of its complete *E-Verify Memorandum of Understanding* issued and electronically signed by the U.S. Department of Homeland Security when the business entity or employer enrolls in the E-Verify program to this Certificate of Compliance.

___ (b) The Contractor/Grantee is not a business entity or employer as those terms are defined in Section 3 of the Act.

3. As of the date of this Certificate, Contractor/Grantee does not knowingly employ an unauthorized alien within the State of Alabama and hereafter it will not knowingly employ, hire for employment, or continue to employ an unauthorized alien within the State of Alabama;
4. Contractor/Grantee is enrolled in E-verify unless it is not eligible to enroll because of the rules of that program or other factor beyond its control.

Certified this _____ day of _____ 20 ____.

Name of Contractor/Grantee/Recipient

By:

Its:

The above Certification was signed in my presence by the person whose name appears above, on

This _____ day of _____ 20 ____.

WITNESS _____

Printed Name of Witness

B.C. # _____

STATEMENT OF COMPLIANCE

with

Act No. 2016-312

“In compliance with Act 2016-312, the contractor hereby certifies that it is not currently engaged in, and will not engage in, the boycott of a person or an entity based in or doing business with a jurisdiction with which this state can enjoy open trade.”

By _____
Signature of Officer of the Company

Date

Name and Title

Company Name

Request for Taxpayer Identification Number and Certification

**Give Form to the
 requester. Do not
 send to the IRS.**

Print or type See Specific Instructions on page 2.	Name (as shown on your income tax return)	
	Business name/disregarded entity name, if different from above	
	Check appropriate box for federal tax classification: <input type="checkbox"/> Individual/sole proprietor <input type="checkbox"/> C Corporation <input type="checkbox"/> S Corporation <input type="checkbox"/> Partnership <input type="checkbox"/> Trust/estate <input type="checkbox"/> Limited liability company. Enter the tax classification (C=C corporation, S=S corporation, P=partnership) ▶ _____ <input type="checkbox"/> Other (see instructions) ▶ _____	
	<input type="checkbox"/> Exempt payee	
	Address (number, street, and apt. or suite no.)	Requester's name and address (optional)
City, state, and ZIP code		
List account number(s) here (optional)		

Part I Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. The TIN provided must match the name given on the "Name" line to avoid backup withholding. For individuals, this is your social security number (SSN). However, for a resident alien, sole proprietor, or disregarded entity, see the Part I instructions on page 3. For other entities, it is your employer identification number (EIN). If you do not have a number, see *How to get a TIN* on page 3.

Social security number									

Note. If the account is in more than one name, see the chart on page 4 for guidelines on whose number to enter.

Employer identification number									

Part II Certification

Under penalties of perjury, I certify that:

1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me), and
2. I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding, and
3. I am a U.S. citizen or other U.S. person (defined below).

Certification instructions. You must cross out item 2 above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return. For real estate transactions, item 2 does not apply. For mortgage interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and generally, payments other than interest and dividends, you are not required to sign the certification, but you must provide your correct TIN. See the instructions on page 4.

Sign Here	Signature of U.S. person ▶	Date ▶
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General Instructions

Section references are to the Internal Revenue Code unless otherwise noted.

Purpose of Form

A person who is required to file an information return with the IRS must obtain your correct taxpayer identification number (TIN) to report, for example, income paid to you, real estate transactions, mortgage interest you paid, acquisition or abandonment of secured property, cancellation of debt, or contributions you made to an IRA.

Use Form W-9 only if you are a U.S. person (including a resident alien), to provide your correct TIN to the person requesting it (the requester) and, when applicable, to:

1. Certify that the TIN you are giving is correct (or you are waiting for a number to be issued),
2. Certify that you are not subject to backup withholding, or
3. Claim exemption from backup withholding if you are a U.S. exempt payee. If applicable, you are also certifying that as a U.S. person, your allocable share of any partnership income from a U.S. trade or business is not subject to the withholding tax on foreign partners' share of effectively connected income.

Note. If a requester gives you a form other than Form W-9 to request your TIN, you must use the requester's form if it is substantially similar to this Form W-9.

Definition of a U.S. person. For federal tax purposes, you are considered a U.S. person if you are:

- An individual who is a U.S. citizen or U.S. resident alien,
- A partnership, corporation, company, or association created or organized in the United States or under the laws of the United States,
- An estate (other than a foreign estate), or
- A domestic trust (as defined in Regulations section 301.7701-7).

Special rules for partnerships. Partnerships that conduct a trade or business in the United States are generally required to pay a withholding tax on any foreign partners' share of income from such business. Further, in certain cases where a Form W-9 has not been received, a partnership is required to presume that a partner is a foreign person, and pay the withholding tax. Therefore, if you are a U.S. person that is a partner in a partnership conducting a trade or business in the United States, provide Form W-9 to the partnership to establish your U.S. status and avoid withholding on your share of partnership income.

The person who gives Form W-9 to the partnership for purposes of establishing its U.S. status and avoiding withholding on its allocable share of net income from the partnership conducting a trade or business in the United States is in the following cases:

- The U.S. owner of a disregarded entity and not the entity,
- The U.S. grantor or other owner of a grantor trust and not the trust, and
- The U.S. trust (other than a grantor trust) and not the beneficiaries of the trust.

Foreign person. If you are a foreign person, do not use Form W-9. Instead, use the appropriate Form W-8 (see Publication 515, Withholding of Tax on Nonresident Aliens and Foreign Entities).

Nonresident alien who becomes a resident alien. Generally, only a nonresident alien individual may use the terms of a tax treaty to reduce or eliminate U.S. tax on certain types of income. However, most tax treaties contain a provision known as a “saving clause.” Exceptions specified in the saving clause may permit an exemption from tax to continue for certain types of income even after the payee has otherwise become a U.S. resident alien for tax purposes.

If you are a U.S. resident alien who is relying on an exception contained in the saving clause of a tax treaty to claim an exemption from U.S. tax on certain types of income, you must attach a statement to Form W-9 that specifies the following five items:

1. The treaty country. Generally, this must be the same treaty under which you claimed exemption from tax as a nonresident alien.
2. The treaty article addressing the income.
3. The article number (or location) in the tax treaty that contains the saving clause and its exceptions.
4. The type and amount of income that qualifies for the exemption from tax.
5. Sufficient facts to justify the exemption from tax under the terms of the treaty article.

Example. Article 20 of the U.S.-China income tax treaty allows an exemption from tax for scholarship income received by a Chinese student temporarily present in the United States. Under U.S. law, this student will become a resident alien for tax purposes if his or her stay in the United States exceeds 5 calendar years. However, paragraph 2 of the first Protocol to the U.S.-China treaty (dated April 30, 1984) allows the provisions of Article 20 to continue to apply even after the Chinese student becomes a resident alien of the United States. A Chinese student who qualifies for this exception (under paragraph 2 of the first protocol) and is relying on this exception to claim an exemption from tax on his or her scholarship or fellowship income would attach to Form W-9 a statement that includes the information described above to support that exemption.

If you are a nonresident alien or a foreign entity not subject to backup withholding, give the requester the appropriate completed Form W-8.

What is backup withholding? Persons making certain payments to you must under certain conditions withhold and pay to the IRS a percentage of such payments. This is called “backup withholding.” Payments that may be subject to backup withholding include interest, tax-exempt interest, dividends, broker and barter exchange transactions, rents, royalties, nonemployee pay, and certain payments from fishing boat operators. Real estate transactions are not subject to backup withholding.

You will not be subject to backup withholding on payments you receive if you give the requester your correct TIN, make the proper certifications, and report all your taxable interest and dividends on your tax return.

Payments you receive will be subject to backup withholding if:

1. You do not furnish your TIN to the requester,
2. You do not certify your TIN when required (see the Part II instructions on page 3 for details),
3. The IRS tells the requester that you furnished an incorrect TIN,
4. The IRS tells you that you are subject to backup withholding because you did not report all your interest and dividends on your tax return (for reportable interest and dividends only), or
5. You do not certify to the requester that you are not subject to backup withholding under 4 above (for reportable interest and dividend accounts opened after 1983 only).

Certain payees and payments are exempt from backup withholding. See the instructions below and the separate Instructions for the Requester of Form W-9.

Also see *Special rules for partnerships* on page 1.

Updating Your Information

You must provide updated information to any person to whom you claimed to be an exempt payee if you are no longer an exempt payee and anticipate receiving reportable payments in the future from this person. For example, you may need to provide updated information if you are a C corporation that elects to be an S corporation, or if you no longer are tax exempt. In addition, you must furnish a new Form W-9 if the name or TIN changes for the account, for example, if the grantor of a grantor trust dies.

Penalties

Failure to furnish TIN. If you fail to furnish your correct TIN to a requester, you are subject to a penalty of \$50 for each such failure unless your failure is due to reasonable cause and not to willful neglect.

Civil penalty for false information with respect to withholding. If you make a false statement with no reasonable basis that results in no backup withholding, you are subject to a \$500 penalty.

Criminal penalty for falsifying information. Willfully falsifying certifications or affirmations may subject you to criminal penalties including fines and/or imprisonment.

Misuse of TINs. If the requester discloses or uses TINs in violation of federal law, the requester may be subject to civil and criminal penalties.

Specific Instructions

Name

If you are an individual, you must generally enter the name shown on your income tax return. However, if you have changed your last name, for instance, due to marriage without informing the Social Security Administration of the name change, enter your first name, the last name shown on your social security card, and your new last name.

If the account is in joint names, list first, and then circle, the name of the person or entity whose number you entered in Part I of the form.

Sole proprietor. Enter your individual name as shown on your income tax return on the “Name” line. You may enter your business, trade, or “doing business as (DBA)” name on the “Business name/disregarded entity name” line.

Partnership, C Corporation, or S Corporation. Enter the entity's name on the “Name” line and any business, trade, or “doing business as (DBA) name” on the “Business name/disregarded entity name” line.

Disregarded entity. Enter the owner's name on the “Name” line. The name of the entity entered on the “Name” line should never be a disregarded entity. The name on the “Name” line must be the name shown on the income tax return on which the income will be reported. For example, if a foreign LLC that is treated as a disregarded entity for U.S. federal tax purposes has a domestic owner, the domestic owner's name is required to be provided on the “Name” line. If the direct owner of the entity is also a disregarded entity, enter the first owner that is not disregarded for federal tax purposes. Enter the disregarded entity's name on the “Business name/disregarded entity name” line. If the owner of the disregarded entity is a foreign person, you must complete an appropriate Form W-8.

Note. Check the appropriate box for the federal tax classification of the person whose name is entered on the “Name” line (Individual/sole proprietor, Partnership, C Corporation, S Corporation, Trust/estate).

Limited Liability Company (LLC). If the person identified on the “Name” line is an LLC, check the “Limited liability company” box only and enter the appropriate code for the tax classification in the space provided. If you are an LLC that is treated as a partnership for federal tax purposes, enter “P” for partnership. If you are an LLC that has filed a Form 8832 or a Form 2553 to be taxed as a corporation, enter “C” for C corporation or “S” for S corporation. If you are an LLC that is disregarded as an entity separate from its owner under Regulation section 301.7701-3 (except for employment and excise tax), do not check the LLC box unless the owner of the LLC (required to be identified on the “Name” line) is another LLC that is not disregarded for federal tax purposes. If the LLC is disregarded as an entity separate from its owner, enter the appropriate tax classification of the owner identified on the “Name” line.

Other entities. Enter your business name as shown on required federal tax documents on the "Name" line. This name should match the name shown on the charter or other legal document creating the entity. You may enter any business, trade, or DBA name on the "Business name/disregarded entity name" line.

Exempt Payee

If you are exempt from backup withholding, enter your name as described above and check the appropriate box for your status, then check the "Exempt payee" box in the line following the "Business name/disregarded entity name," sign and date the form.

Generally, individuals (including sole proprietors) are not exempt from backup withholding. Corporations are exempt from backup withholding for certain payments, such as interest and dividends.

Note. If you are exempt from backup withholding, you should still complete this form to avoid possible erroneous backup withholding.

The following payees are exempt from backup withholding:

1. An organization exempt from tax under section 501(a), any IRA, or a custodial account under section 403(b)(7) if the account satisfies the requirements of section 401(f)(2),
 2. The United States or any of its agencies or instrumentalities,
 3. A state, the District of Columbia, a possession of the United States, or any of their political subdivisions or instrumentalities,
 4. A foreign government or any of its political subdivisions, agencies, or instrumentalities, or
 5. An international organization or any of its agencies or instrumentalities.
- Other payees that may be exempt from backup withholding include:
6. A corporation,
 7. A foreign central bank of issue,
 8. A dealer in securities or commodities required to register in the United States, the District of Columbia, or a possession of the United States,
 9. A futures commission merchant registered with the Commodity Futures Trading Commission,
 10. A real estate investment trust,
 11. An entity registered at all times during the tax year under the Investment Company Act of 1940,
 12. A common trust fund operated by a bank under section 584(a),
 13. A financial institution,
 14. A middleman known in the investment community as a nominee or custodian, or
 15. A trust exempt from tax under section 664 or described in section 4947.

The following chart shows types of payments that may be exempt from backup withholding. The chart applies to the exempt payees listed above, 1 through 15.

IF the payment is for . . .	THEN the payment is exempt for . . .
Interest and dividend payments	All exempt payees except for 9
Broker transactions	Exempt payees 1 through 5 and 7 through 13. Also, C corporations.
Barter exchange transactions and patronage dividends	Exempt payees 1 through 5
Payments over \$600 required to be reported and direct sales over \$5,000 ¹	Generally, exempt payees 1 through 7 ²

¹ See Form 1099-MISC, Miscellaneous Income, and its instructions.

² However, the following payments made to a corporation and reportable on Form 1099-MISC are not exempt from backup withholding: medical and health care payments, attorneys' fees, gross proceeds paid to an attorney, and payments for services paid by a federal executive agency.

Part I. Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. If you are a resident alien and you do not have and are not eligible to get an SSN, your TIN is your IRS individual taxpayer identification number (ITIN). Enter it in the social security number box. If you do not have an ITIN, see *How to get a TIN* below.

If you are a sole proprietor and you have an EIN, you may enter either your SSN or EIN. However, the IRS prefers that you use your SSN.

If you are a single-member LLC that is disregarded as an entity separate from its owner (see *Limited Liability Company (LLC)* on page 2), enter the owner's SSN (or EIN, if the owner has one). Do not enter the disregarded entity's EIN. If the LLC is classified as a corporation or partnership, enter the entity's EIN.

Note. See the chart on page 4 for further clarification of name and TIN combinations.

How to get a TIN. If you do not have a TIN, apply for one immediately. To apply for an SSN, get Form SS-5, Application for a Social Security Card, from your local Social Security Administration office or get this form online at www.ssa.gov. You may also get this form by calling 1-800-772-1213. Use Form W-7, Application for IRS Individual Taxpayer Identification Number, to apply for an ITIN, or Form SS-4, Application for Employer Identification Number, to apply for an EIN. You can apply for an EIN online by accessing the IRS website at www.irs.gov/businesses and clicking on Employer Identification Number (EIN) under Starting a Business. You can get Forms W-7 and SS-4 from the IRS by visiting IRS.gov or by calling 1-800-TAX-FORM (1-800-829-3676).

If you are asked to complete Form W-9 but do not have a TIN, write "Applied For" in the space for the TIN, sign and date the form, and give it to the requester. For interest and dividend payments, and certain payments made with respect to readily tradable instruments, generally you will have 60 days to get a TIN and give it to the requester before you are subject to backup withholding on payments. The 60-day rule does not apply to other types of payments. You will be subject to backup withholding on all such payments until you provide your TIN to the requester.

Note. Entering "Applied For" means that you have already applied for a TIN or that you intend to apply for one soon.

Caution: A disregarded domestic entity that has a foreign owner must use the appropriate Form W-8.

Part II. Certification

To establish to the withholding agent that you are a U.S. person, or resident alien, sign Form W-9. You may be requested to sign by the withholding agent even if item 1, below, and items 4 and 5 on page 4 indicate otherwise.

For a joint account, only the person whose TIN is shown in Part I should sign (when required). In the case of a disregarded entity, the person identified on the "Name" line must sign. Exempt payees, see *Exempt Payee* on page 3.

Signature requirements. Complete the certification as indicated in items 1 through 3, below, and items 4 and 5 on page 4.

1. Interest, dividend, and barter exchange accounts opened before 1984 and broker accounts considered active during 1983. You must give your correct TIN, but you do not have to sign the certification.

2. Interest, dividend, broker, and barter exchange accounts opened after 1983 and broker accounts considered inactive during 1983. You must sign the certification or backup withholding will apply. If you are subject to backup withholding and you are merely providing your correct TIN to the requester, you must cross out item 2 in the certification before signing the form.

3. Real estate transactions. You must sign the certification. You may cross out item 2 of the certification.

4. Other payments. You must give your correct TIN, but you do not have to sign the certification unless you have been notified that you have previously given an incorrect TIN. "Other payments" include payments made in the course of the requester's trade or business for rents, royalties, goods (other than bills for merchandise), medical and health care services (including payments to corporations), payments to a nonemployee for services, payments to certain fishing boat crew members and fishermen, and gross proceeds paid to attorneys (including payments to corporations).

5. Mortgage interest paid by you, acquisition or abandonment of secured property, cancellation of debt, qualified tuition program payments (under section 529), IRA, Coverdell ESA, Archer MSA or HSA contributions or distributions, and pension distributions. You must give your correct TIN, but you do not have to sign the certification.

What Name and Number To Give the Requester

For this type of account:	Give name and SSN of:
1. Individual	The individual
2. Two or more individuals (joint account)	The actual owner of the account or, if combined funds, the first individual on the account ¹
3. Custodian account of a minor (Uniform Gift to Minors Act)	The minor ²
4. a. The usual revocable savings trust (grantor is also trustee) b. So-called trust account that is not a legal or valid trust under state law	The grantor-trustee ¹ The actual owner ¹
5. Sole proprietorship or disregarded entity owned by an individual	The owner ³
6. Grantor trust filing under Optional Form 1099 Filing Method 1 (see Regulation section 1.671-4(b)(2)(i)(A))	The grantor*
For this type of account:	Give name and EIN of:
7. Disregarded entity not owned by an individual	The owner
8. A valid trust, estate, or pension trust	Legal entity ⁴
9. Corporation or LLC electing corporate status on Form 8832 or Form 2553	The corporation
10. Association, club, religious, charitable, educational, or other tax-exempt organization	The organization
11. Partnership or multi-member LLC	The partnership
12. A broker or registered nominee	The broker or nominee
13. Account with the Department of Agriculture in the name of a public entity (such as a state or local government, school district, or prison) that receives agricultural program payments	The public entity
14. Grantor trust filing under the Form 1041 Filing Method or the Optional Form 1099 Filing Method 2 (see Regulation section 1.671-4(b)(2)(i)(B))	The trust

¹ List first and circle the name of the person whose number you furnish. If only one person on a joint account has an SSN, that person's number must be furnished.

² Circle the minor's name and furnish the minor's SSN.

³ You must show your individual name and you may also enter your business or "DBA" name on the "Business name/disregarded entity" name line. You may use either your SSN or EIN (if you have one), but the IRS encourages you to use your SSN.

⁴ List first and circle the name of the trust, estate, or pension trust. (Do not furnish the TIN of the personal representative or trustee unless the legal entity itself is not designated in the account title.) Also see *Special rules for partnerships* on page 1.

*Note. Grantor also must provide a Form W-9 to trustee of trust.

Note. If no name is circled when more than one name is listed, the number will be considered to be that of the first name listed.

Secure Your Tax Records from Identity Theft

Identity theft occurs when someone uses your personal information such as your name, social security number (SSN), or other identifying information, without your permission, to commit fraud or other crimes. An identity thief may use your SSN to get a job or may file a tax return using your SSN to receive a refund.

To reduce your risk:

- Protect your SSN,
- Ensure your employer is protecting your SSN, and
- Be careful when choosing a tax preparer.

If your tax records are affected by identity theft and you receive a notice from the IRS, respond right away to the name and phone number printed on the IRS notice or letter.

If your tax records are not currently affected by identity theft but you think you are at risk due to a lost or stolen purse or wallet, questionable credit card activity or credit report, contact the IRS Identity Theft Hotline at 1-800-908-4490 or submit Form 14039.

For more information, see Publication 4535, Identity Theft Prevention and Victim Assistance.

Victims of identity theft who are experiencing economic harm or a system problem, or are seeking help in resolving tax problems that have not been resolved through normal channels, may be eligible for Taxpayer Advocate Service (TAS) assistance. You can reach TAS by calling the TAS toll-free case intake line at 1-877-777-4778 or TTY/TDD 1-800-829-4059.

Protect yourself from suspicious emails or phishing schemes.

Phishing is the creation and use of email and websites designed to mimic legitimate business emails and websites. The most common act is sending an email to a user falsely claiming to be an established legitimate enterprise in an attempt to scam the user into surrendering private information that will be used for identity theft.

The IRS does not initiate contacts with taxpayers via emails. Also, the IRS does not request personal detailed information through email or ask taxpayers for the PIN numbers, passwords, or similar secret access information for their credit card, bank, or other financial accounts.

If you receive an unsolicited email claiming to be from the IRS, forward this message to phishing@irs.gov. You may also report misuse of the IRS name, logo, or other IRS property to the Treasury Inspector General for Tax Administration at 1-800-366-4484. You can forward suspicious emails to the Federal Trade Commission at: spam@uce.gov or contact them at www.ftc.gov/idtheft or 1-877-IDTHEFT (1-877-438-4338).

Visit IRS.gov to learn more about identity theft and how to reduce your risk.

Privacy Act Notice

Section 6109 of the Internal Revenue Code requires you to provide your correct TIN to persons (including federal agencies) who are required to file information returns with the IRS to report interest, dividends, or certain other income paid to you; mortgage interest you paid; the acquisition or abandonment of secured property; the cancellation of debt; or contributions you made to an IRA, Archer MSA, or HSA. The person collecting this form uses the information on the form to file information returns with the IRS, reporting the above information. Routine uses of this information include giving it to the Department of Justice for civil and criminal litigation and to cities, states, the District of Columbia, and U.S. possessions for use in administering their laws. The information also may be disclosed to other countries under a treaty, to federal and state agencies to enforce civil and criminal laws, or to federal law enforcement and intelligence agencies to combat terrorism. You must provide your TIN whether or not you are required to file a tax return. Under section 3406, payers must generally withhold a percentage of taxable interest, dividend, and certain other payments to a payee who does not give a TIN to the payer. Certain penalties may also apply for providing false or fraudulent information.

Certification for Contracts, Grants, Loans, and Cooperative Agreements

The undersigned certifies, to the best of his or her knowledge and belief, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

The Contractor, _____, certifies or affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the Contractor understands and agrees that the provisions of 31 U.S.C. Chap. 38, Administrative Remedies for False Claims and Statements, apply to this certification and disclosure, if any.

Signature of Contractor's Authorized Official

Name and Title of Contractor's Authorized Official

Date



Company ID Number: _____

**THE E-VERIFY PROGRAM FOR EMPLOYMENT VERIFICATION
MEMORANDUM OF UNDERSTANDING**

ARTICLE I

PURPOSE AND AUTHORITY

This Memorandum of Understanding (MOU) sets forth the points of agreement between the Department of Homeland Security (DHS) and _____ (Employer) regarding the Employer's participation in the Employment Eligibility Verification Program (E-Verify). This MOU explains certain features of the E-Verify program and enumerates specific responsibilities of DHS, the Social Security Administration (SSA), and the Employer. E-Verify is a program that electronically confirms an employee's eligibility to work in the United States after completion of the Employment Eligibility Verification Form (Form I-9). For covered government contractors, E-Verify is used to verify the employment eligibility of all newly hired employees and all existing employees assigned to Federal contracts or to verify the entire workforce if the contractor so chooses.

Authority for the E-Verify program is found in Title IV, Subtitle A, of the Illegal Immigration Reform and Immigrant Responsibility Act of 1996 (IIRIRA), Pub. L. 104-208, 110 Stat. 3009, as amended (8 U.S.C. § 1324a note). Authority for use of the E-Verify program by Federal contractors and subcontractors covered by the terms of Subpart 22.18, "Employment Eligibility Verification", of the Federal Acquisition Regulation (FAR) (hereinafter referred to in this MOU as a "Federal contractor with the FAR E-Verify clause") to verify the employment eligibility of certain employees working on Federal contracts is also found in Subpart 22.18 and in Executive Order 12989, as amended.

ARTICLE II

FUNCTIONS TO BE PERFORMED

A. RESPONSIBILITIES OF SSA

1. SSA agrees to provide the Employer with available information that allows the Employer to confirm the accuracy of Social Security Numbers provided by all employees verified under this MOU and the employment authorization of U.S. citizens.
2. SSA agrees to provide to the Employer appropriate assistance with operational problems that may arise during the Employer's participation in the E-Verify program. SSA agrees to provide the Employer with names, titles, addresses, and telephone numbers of SSA representatives to be contacted during the E-Verify process.
3. SSA agrees to safeguard the information provided by the Employer through the E-Verify program procedures, and to limit access to such information, as is appropriate by law, to individuals responsible for the verification of Social Security Numbers and for evaluation of the E-Verify program or such other persons or entities who may be authorized by SSA as governed

Company ID Number:

by the Privacy Act (5 U.S.C. § 552a), the Social Security Act (42 U.S.C. 1306(a)), and SSA regulations (20 CFR Part 401).

4. SSA agrees to provide a means of automated verification that is designed (in conjunction with DHS's automated system if necessary) to provide confirmation or tentative nonconfirmation of U.S. citizens' employment eligibility within 3 Federal Government work days of the initial inquiry.

5. SSA agrees to provide a means of secondary verification (including updating SSA records as may be necessary) for employees who contest SSA tentative nonconfirmations that is designed to provide final confirmation or nonconfirmation of U.S. citizens' employment eligibility and accuracy of SSA records for both citizens and non-citizens within 10 Federal Government work days of the date of referral to SSA, unless SSA determines that more than 10 days may be necessary. In such cases, SSA will provide additional verification instructions.

B. RESPONSIBILITIES OF DHS

1. After SSA verifies the accuracy of SSA records for employees through E-Verify, DHS agrees to provide the Employer access to selected data from DHS's database to enable the Employer to conduct, to the extent authorized by this MOU:

- Automated verification checks on employees by electronic means, and
- Photo verification checks (when available) on employees.

2. DHS agrees to provide to the Employer appropriate assistance with operational problems that may arise during the Employer's participation in the E-Verify program. DHS agrees to provide the Employer names, titles, addresses, and telephone numbers of DHS representatives to be contacted during the E-Verify process.

3. DHS agrees to make available to the Employer at the E-Verify Web site and on the E-Verify Web browser, instructional materials on E-Verify policies, procedures and requirements for both SSA and DHS, including restrictions on the use of E-Verify. DHS agrees to provide training materials on E-Verify.

4. DHS agrees to provide to the Employer a notice, which indicates the Employer's participation in the E-Verify program. DHS also agrees to provide to the Employer anti-discrimination notices issued by the Office of Special Counsel for Immigration-Related Unfair Employment Practices (OSC), Civil Rights Division, U.S. Department of Justice.

5. DHS agrees to issue the Employer a user identification number and password that permits the Employer to verify information provided by employees with DHS's database.

6. DHS agrees to safeguard the information provided to DHS by the Employer, and to limit access to such information to individuals responsible for the verification of employees' employment eligibility and for evaluation of the E-Verify program, or to such other persons or entities as may be authorized by applicable law. Information will be used only to verify the accuracy of Social Security Numbers and employment eligibility, to enforce the Immigration and

Company ID Number:

Nationality Act (INA) and Federal criminal laws, and to administer Federal contracting requirements.

7. DHS agrees to provide a means of automated verification that is designed (in conjunction with SSA verification procedures) to provide confirmation or tentative nonconfirmation of employees' employment eligibility within 3 Federal Government work days of the initial inquiry.

8. DHS agrees to provide a means of secondary verification (including updating DHS records as may be necessary) for employees who contest DHS tentative nonconfirmations and photo non-match tentative nonconfirmations that is designed to provide final confirmation or nonconfirmation of the employees' employment eligibility within 10 Federal Government work days of the date of referral to DHS, unless DHS determines that more than 10 days may be necessary. In such cases, DHS will provide additional verification instructions.

C. RESPONSIBILITIES OF THE EMPLOYER

1. The Employer agrees to display the notices supplied by DHS in a prominent place that is clearly visible to prospective employees and all employees who are to be verified through the system.

2. The Employer agrees to provide to the SSA and DHS the names, titles, addresses, and telephone numbers of the Employer representatives to be contacted regarding E-Verify.

3. The Employer agrees to become familiar with and comply with the most recent version of the E-Verify User Manual.

4. The Employer agrees that any Employer Representative who will perform employment verification queries will complete the E-Verify Tutorial before that Individual initiates any queries.

A. The Employer agrees that all Employer representatives will take the refresher tutorials initiated by the E-Verify program as a condition of continued use of E-Verify.

B. Failure to complete a refresher tutorial will prevent the Employer from continued use of the program.

5. The Employer agrees to comply with current Form I-9 procedures, with two exceptions:

- If an employee presents a "List B" identity document, the Employer agrees to only accept "List B" documents that contain a photo. (List B documents identified in 8 C.F.R. § 274a.2(b)(1)(B)) can be presented during the Form I-9 process to establish identity.) If an employee objects to the photo requirement for religious reasons, the Employer should contact E-Verify at 888-464-4218.

- If an employee presents a DHS Form I-551 (Permanent Resident Card) or Form I-766 (Employment Authorization Document) to complete the Form I-9, the Employer agrees to make a photocopy of the document and to retain the photocopy with the employee's Form I-9. The photocopy must be of sufficient quality to allow for verification of the photo



Company ID Number:

and written information. The employer will use the photocopy to verify the photo and to assist DHS with its review of photo non-matches that are contested by employees. Note that employees retain the right to present any List A, or List B and List C, documentation to complete the Form I-9. DHS may in the future designate other documents that activate the photo screening tool.

6. The Employer understands that participation in E-Verify does not exempt the Employer from the responsibility to complete, retain, and make available for inspection Forms I-9 that relate to its employees, or from other requirements of applicable regulations or laws, including the obligation to comply with the antidiscrimination requirements of section 274B of the INA with respect to Form I-9 procedures, except for the following modified requirements applicable by reason of the Employer's participation in E-Verify: (1) identity documents must have photos, as described in paragraph 5 above; (2) a rebuttable presumption is established that the Employer has not violated section 274A(a)(1)(A) of the Immigration and Nationality Act (INA) with respect to the hiring of any individual if it obtains confirmation of the identity and employment eligibility of the individual in good faith compliance with the terms and conditions of E-Verify; (3) the Employer must notify DHS if it continues to employ any employee after receiving a final nonconfirmation, and is subject to a civil money penalty between \$550 and \$1,100 for each failure to notify DHS of continued employment following a final nonconfirmation; (4) the Employer is subject to a rebuttable presumption that it has knowingly employed an unauthorized alien in violation of section 274A(a)(1)(A) if the Employer continues to employ an employee after receiving a final nonconfirmation; and (5) no person or entity participating in E-Verify is civilly or criminally liable under any law for any action taken in good faith based on information provided through the confirmation system. DHS reserves the right to conduct Form I-9 and E-Verify system compliance inspections during the course of E-Verify, as well as to conduct any other enforcement activity authorized by law.

7. The Employer agrees to initiate E-Verify verification procedures for new employees within 3 Employer business days after each employee has been hired (but after the Form I-9 has been completed), and to complete as many (but only as many) steps of the E-Verify process as are necessary according to the E-Verify User Manual, or in the case of Federal contractors with the FAR E-Verify clause, the E-Verify User Manual for Federal Contractors. The Employer is prohibited from initiating verification procedures before the employee has been hired and the Form I-9 completed. If the automated system to be queried is temporarily unavailable, the 3-day time period is extended until it is again operational in order to accommodate the Employer's attempting, in good faith, to make inquiries during the period of unavailability. Employers may initiate verification by notating the Form I-9 in circumstances where the employee has applied for a Social Security Number (SSN) from the SSA and is waiting to receive the SSN, provided that the Employer performs an E-Verify employment verification query using the employee's SSN as soon as the SSN becomes available.

8. The Employer agrees not to use E-Verify procedures for pre-employment screening of job applicants, in support of any unlawful employment practice, or for any other use not authorized by this MOU. Employers must use E-Verify for all new employees, unless an Employer is a Federal contractor that qualifies for the exceptions described in Article II.D.1.c. Except as provided in Article II.D, the Employer will not verify selectively and will not verify employees hired before the effective date of this MOU. The Employer understands that if the Employer



Company ID Number:

uses the E-Verify system for any purpose other than as authorized by this MOU, the Employer may be subject to appropriate legal action and termination of its access to SSA and DHS information pursuant to this MOU.

9. The Employer agrees to follow appropriate procedures (see Article III. below) regarding tentative nonconfirmations, including notifying employees in private of the finding and providing them written notice of the findings, providing written referral instructions to employees, allowing employees to contest the finding, and not taking adverse action against employees if they choose to contest the finding. Further, when employees contest a tentative nonconfirmation based upon a photo non-match, the Employer is required to take affirmative steps (see Article III.B. below) to contact DHS with information necessary to resolve the challenge.

10. The Employer agrees not to take any adverse action against an employee based upon the employee's perceived employment eligibility status while SSA or DHS is processing the verification request unless the Employer obtains knowledge (as defined in 8 C.F.R. § 274a.1(l)) that the employee is not work authorized. The Employer understands that an initial inability of the SSA or DHS automated verification system to verify work authorization, a tentative nonconfirmation, a case in continuance (indicating the need for additional time for the government to resolve a case), or the finding of a photo non-match, does not establish, and should not be interpreted as evidence, that the employee is not work authorized. In any of the cases listed above, the employee must be provided a full and fair opportunity to contest the finding, and if he or she does so, the employee may not be terminated or suffer any adverse employment consequences based upon the employee's perceived employment eligibility status (including denying, reducing, or extending work hours, delaying or preventing training, requiring an employee to work in poorer conditions, refusing to assign the employee to a Federal contract or other assignment, or otherwise subjecting an employee to any assumption that he or she is unauthorized to work) until and unless secondary verification by SSA or DHS has been completed and a final nonconfirmation has been issued. If the employee does not choose to contest a tentative nonconfirmation or a photo non-match or if a secondary verification is completed and a final nonconfirmation is issued, then the Employer can find the employee is not work authorized and terminate the employee's employment. Employers or employees with questions about a final nonconfirmation may call E-Verify at 1-888-464-4218 or OSC at 1-800-255-8155 or 1-800-237-2515 (TDD).

11. The Employer agrees to comply with Title VII of the Civil Rights Act of 1964 and section 274B of the INA, as applicable, by not discriminating unlawfully against any individual in hiring, firing, or recruitment or referral practices because of his or her national origin or, in the case of a protected individual as defined in section 274B(a)(3) of the INA, because of his or her citizenship status. The Employer understands that such illegal practices can include selective verification or use of E-Verify except as provided in part D below, or discharging or refusing to hire employees because they appear or sound "foreign" or have received tentative nonconfirmations. The Employer further understands that any violation of the unfair immigration-related employment practices provisions in section 274B of the INA could subject the Employer to civil penalties, back pay awards, and other sanctions, and violations of Title VII could subject the Employer to back pay awards, compensatory and punitive damages. Violations of either section 274B of the INA or Title VII may also lead to the termination of its participation in E-



Company ID Number: .

Verify. If the Employer has any questions relating to the anti-discrimination provision, it should contact OSC at 1-800-255-8155 or 1-800-237-2515 (TDD).

12. The Employer agrees to record the case verification number on the employee's Form I-9 or to print the screen containing the case verification number and attach it to the employee's Form I-9.

13. The Employer agrees that it will use the information it receives from SSA or DHS pursuant to E-Verify and this MOU only to confirm the employment eligibility of employees as authorized by this MOU. The Employer agrees that it will safeguard this information, and means of access to it (such as PINS and passwords) to ensure that it is not used for any other purpose and as necessary to protect its confidentiality, including ensuring that it is not disseminated to any person other than employees of the Employer who are authorized to perform the Employer's responsibilities under this MOU, except for such dissemination as may be authorized in advance by SSA or DHS for legitimate purposes.

14. The Employer acknowledges that the information which it receives from SSA is governed by the Privacy Act (5 U.S.C. § 552a(i)(1) and (3)) and the Social Security Act (42 U.S.C. 1306(a)), and that any person who obtains this information under false pretenses or uses it for any purpose other than as provided for in this MOU may be subject to criminal penalties.

15. The Employer agrees to cooperate with DHS and SSA in their compliance monitoring and evaluation of E-Verify, including by permitting DHS and SSA, upon reasonable notice, to review Forms I-9 and other employment records and to interview it and its employees regarding the Employer's use of E-Verify, and to respond in a timely and accurate manner to DHS requests for information relating to their participation in E-Verify.

D. RESPONSIBILITIES OF FEDERAL CONTRACTORS WITH THE FAR E-VERIFY CLAUSE

1. The Employer understands that if it is a subject to the employment verification terms in Subpart 22.18 of the FAR, it must verify the employment eligibility of any existing employee assigned to the contract and all new hires, as discussed in the Supplemental Guide for Federal Contractors. Once an employee has been verified through E-Verify by the Employer, the Employer may not reverify the employee through E-Verify.

a. Federal contractors with the FAR E-Verify clause agree to become familiar with and comply with the most recent versions of the E-Verify User Manual for Federal Contractors and the E-Verify Supplemental Guide for Federal Contractors.

b. Federal contractors with the FAR E-Verify clause agree to complete a tutorial for Federal contractors with the FAR E-Verify clause.

c. Federal contractors with the FAR E-Verify clause not enrolled at the time of contract award: An Employer that is not enrolled in E-Verify at the time of a contract award must enroll as a Federal contractor with the FAR E-Verify clause in E-Verify within 30 calendar days of contract award and, within 90 days of enrollment, begin to use E-Verify to initiate verification of employment eligibility of new hires of the Employer who are working in the United States,

E-Verify



Company ID Number:

whether or not assigned to the contract. Once the Employer begins verifying new hires, such verification of new hires must be initiated within 3 business days after the date of hire. Once enrolled in E-Verify as a Federal contractor with the FAR E-Verify clause, the Employer must initiate verification of employees assigned to the contract within 90 calendar days from the time of enrollment in the system and after the date and selecting which employees will be verified in E-Verify or within 30 days of an employee's assignment to the contract, whichever date is later.

d. Employers that are already enrolled in E-Verify at the time of a contract award but are not enrolled in the system as a Federal contractor with the FAR E-Verify clause: Employers enrolled in E-Verify for 90 days or more at the time of a contract award must use E-Verify to initiate verification of employment eligibility for new hires of the Employer who are working in the United States, whether or not assigned to the contract, within 3 business days after the date of hire. Employers enrolled in E-Verify as other than a Federal contractor with the FAR E-Verify clause, must update E-Verify to indicate that they are a Federal contractor with the FAR E-Verify clause within 30 days after assignment to the contract. If the Employer is enrolled in E-Verify for 90 calendar days or less at the time of contract award, the Employer must, within 90 days of enrollment, begin to use E-Verify to initiate verification of new hires of the contractor who are working in the United States, whether or not assigned to the contract. Such verification of new hires must be initiated within 3 business days after the date of hire. An Employer enrolled as a Federal contractor with the FAR E-Verify clause in E-Verify must initiate verification of each employee assigned to the contract within 90 calendar days after date of contract award or within 30 days after assignment to the contract, whichever is later.

e. Institutions of higher education, State, local and tribal governments and sureties: Federal contractors with the FAR E-Verify clause that are institutions of higher education (as defined at 20 U.S.C. 1001(a)), State or local governments, governments of Federally recognized Indian tribes, or sureties performing under a takeover agreement entered into with a Federal agency pursuant to a performance bond may choose to only verify new and existing employees assigned to the Federal contract. Such Federal contractors with the FAR E-Verify clause may, however, elect to verify all new hires, and/or all existing employees hired after November 6, 1986. The provisions of Article II.D, paragraphs 1.a and 1.b of this MOU providing timeframes for initiating employment verification of employees assigned to a contract apply to such institutions of higher education, State, local and tribal governments, and sureties.

f. Verification of all employees: Upon enrollment, Employers who are Federal contractors with the FAR E-Verify clause may elect to verify employment eligibility of all existing employees working in the United States who were hired after November 6, 1986, instead of verifying only new employees and those existing employees assigned to a covered Federal contract. After enrollment, Employers must elect to do so only in the manner designated by DHS and initiate E-Verify verification of all existing employees within 180 days after the election.

g. Form I-9 procedures for existing employees of Federal contractors with the FAR E-Verify clause: Federal contractors with the FAR E-Verify clause may choose to complete new Forms I-9 for all existing employees other than those that are completely exempt from this process. Federal contractors with the FAR E-Verify clause may also update previously completed Forms I-9 to initiate E-Verify verification of existing employees who are not completely exempt as long as that Form I-9 is complete (including the SSN), complies with

Company ID Number:

Article II.C.5, the employee's work authorization has not expired, and the Employer has reviewed the information reflected in the Form I-9 either in person or in communications with the employee to ensure that the employee's stated basis in section 1 of the Form I-9 for work authorization has not changed (including, but not limited to, a lawful permanent resident alien having become a naturalized U.S. citizen). If the Employer is unable to determine that the Form I-9 complies with Article II.C.5, if the employee's basis for work authorization as attested in section 1 has expired or changed, or if the Form I-9 contains no SSN or is otherwise incomplete, the Employer shall complete a new I-9 consistent with Article II.C.5, or update the previous I-9 to provide the necessary information. If section 1 of the Form I-9 is otherwise valid and up-to-date and the form otherwise complies with Article II.C.5, but reflects documentation (such as a U.S. passport or Form I-551) that expired subsequent to completion of the Form I-9, the Employer shall not require the production of additional documentation, or use the photo screening tool described in Article II.C.5, subject to any additional or superseding instructions that may be provided on this subject in the Supplemental Guide for Federal Contractors. Nothing in this section shall be construed to require a second verification using E-Verify of any assigned employee who has previously been verified as a newly hired employee under this MOU, or to authorize verification of any existing employee by any Employer that is not a Federal contractor with the FAR E-Verify clause.

2. The Employer understands that if it is a Federal contractor with the FAR E-Verify clause, its compliance with this MOU is a performance requirement under the terms of the Federal contract or subcontract, and the Employer consents to the release of information relating to compliance with its verification responsibilities under this MOU to contracting officers or other officials authorized to review the Employer's compliance with Federal contracting requirements.

ARTICLE III

REFERRAL OF INDIVIDUALS TO SSA AND DHS

A. REFERRAL TO SSA

1. If the Employer receives a tentative nonconfirmation issued by SSA, the Employer must print the notice as directed by the E-Verify system and provide it to the employee so that the employee may determine whether he or she will contest the tentative nonconfirmation. The Employer must review the tentative nonconfirmation with the employee in private.

2. The Employer will refer employees to SSA field offices only as directed by the automated system based on a tentative nonconfirmation, and only after the Employer records the case verification number, reviews the input to detect any transaction errors, and determines that the employee contests the tentative nonconfirmation. The Employer will transmit the Social Security Number to SSA for verification again if this review indicates a need to do so. The Employer will determine whether the employee contests the tentative nonconfirmation as soon as possible after the Employer receives it.

3. If the employee contests an SSA tentative nonconfirmation, the Employer will provide the employee with a system-generated referral letter and instruct the employee to visit an SSA office within 8 Federal Government work days. SSA will electronically transmit the result of the referral to the Employer within 10 Federal Government work days of the referral unless it

Company ID Number:

determines that more than 10 days is necessary. The Employer agrees to check the E-Verify system regularly for case updates.

4. The Employer agrees not to ask the employee to obtain a printout from the Social Security Number database (the Numident) or other written verification of the Social Security Number from the SSA.

B. REFERRAL TO DHS

1. If the Employer receives a tentative nonconfirmation issued by DHS, the Employer must print the tentative nonconfirmation notice as directed by the E-Verify system and provide it to the employee so that the employee may determine whether he or she will contest the tentative nonconfirmation. The Employer must review the tentative nonconfirmation with the employee in private.

2. If the Employer finds a photo non-match for an employee who provides a document for which the automated system has transmitted a photo, the employer must print the photo non-match tentative nonconfirmation notice as directed by the automated system and provide it to the employee so that the employee may determine whether he or she will contest the finding. The Employer must review the tentative nonconfirmation with the employee in private.

3. The Employer agrees to refer individuals to DHS only when the employee chooses to contest a tentative nonconfirmation received from DHS automated verification process or when the Employer issues a tentative nonconfirmation based upon a photo non-match. The Employer will determine whether the employee contests the tentative nonconfirmation as soon as possible after the Employer receives it.

4. If the employee contests a tentative nonconfirmation issued by DHS, the Employer will provide the employee with a referral letter and instruct the employee to contact DHS through its toll-free hotline (as found on the referral letter) within 8 Federal Government work days.

5. If the employee contests a tentative nonconfirmation based upon a photo non-match, the Employer will provide the employee with a referral letter to DHS. DHS will electronically transmit the result of the referral to the Employer within 10 Federal Government work days of the referral unless it determines that more than 10 days is necessary. The Employer agrees to check the E-Verify system regularly for case updates.

6. The Employer agrees that if an employee contests a tentative nonconfirmation based upon a photo non-match, the Employer will send a copy of the employee's Form I-551 or Form I-766 to DHS for review by:

- Scanning and uploading the document, or
- Sending a photocopy of the document by an express mail account (paid for at employer expense).

7. If the Employer determines that there is a photo non-match when comparing the photocopied List B document described in Article II.C.5 with the image generated in E-Verify, the Employer must forward the employee's documentation to DHS using one of the means described in the preceding paragraph, and allow DHS to resolve the case.



Company ID Number:

ARTICLE IV

SERVICE PROVISIONS

SSA and DHS will not charge the Employer for verification services performed under this MOU. The Employer is responsible for providing equipment needed to make inquiries. To access E-Verify, an Employer will need a personal computer with Internet access.

ARTICLE V

PARTIES

A. This MOU is effective upon the signature of all parties, and shall continue in effect for as long as the SSA and DHS conduct the E-Verify program unless modified in writing by the mutual consent of all parties, or terminated by any party upon 30 days prior written notice to the others. Any and all system enhancements to the E-Verify program by DHS or SSA, including but not limited to the E-Verify checking against additional data sources and instituting new verification procedures, will be covered under this MOU and will not cause the need for a supplemental MOU that outlines these changes. DHS agrees to train employers on all changes made to E-Verify through the use of mandatory refresher tutorials and updates to the E-Verify User Manual, the E-Verify User Manual for Federal Contractors or the E-Verify Supplemental Guide for Federal Contractors. Even without changes to E-Verify, DHS reserves the right to require employers to take mandatory refresher tutorials. An Employer that is a Federal contractor with the FAR E-Verify clause may terminate this MOU when the Federal contract that requires its participation in E-Verify is terminated or completed. In such a circumstance, the Federal contractor with the FAR E-Verify clause must provide written notice to DHS. If an Employer that is a Federal contractor with the FAR E-Verify clause fails to provide such notice, that Employer will remain a participant in the E-Verify program, will remain bound by the terms of this MOU that apply to participants that are not Federal contractors with the FAR E-Verify clause, and will be required to use the E-Verify procedures to verify the employment eligibility of all newly hired employees.

B. Notwithstanding Article V, part A of this MOU, DHS may terminate this MOU if deemed necessary because of the requirements of law or policy, or upon a determination by SSA or DHS that there has been a breach of system integrity or security by the Employer, or a failure on the part of the Employer to comply with established procedures or legal requirements. The Employer understands that if it is a Federal contractor with the FAR E-Verify clause, termination of this MOU by any party for any reason may negatively affect its performance of its contractual responsibilities.

C. Some or all SSA and DHS responsibilities under this MOU may be performed by contractor(s), and SSA and DHS may adjust verification responsibilities between each other as they may determine necessary. By separate agreement with DHS, SSA has agreed to perform its responsibilities as described in this MOU.

E-Verify



Company ID Number:

D. Nothing in this MOU is intended, or should be construed, to create any right or benefit, substantive or procedural, enforceable at law by any third party against the United States, its agencies, officers, or employees, or against the Employer, its agents, officers, or employees.

E. Each party shall be solely responsible for defending any claim or action against it arising out of or related to E-Verify or this MOU, whether civil or criminal, and for any liability wherefrom, including (but not limited to) any dispute between the Employer and any other person or entity regarding the applicability of Section 403(d) of IIRIRA to any action taken or allegedly taken by the Employer.

F. The Employer understands that the fact of its participation in E-Verify is not confidential information and may be disclosed as authorized or required by law and DHS or SSA policy, including but not limited to, Congressional oversight, E-Verify publicity and media inquiries, determinations of compliance with Federal contractual requirements, and responses to inquiries under the Freedom of Information Act (FOIA).

G. The foregoing constitutes the full agreement on this subject between DHS and the Employer.

H. The individuals whose signatures appear below represent that they are authorized to enter into this MOU on behalf of the Employer and DHS respectively.



Company ID Number: /

To be accepted as a participant in E-Verify, you should only sign the Employer's Section of the signature page. If you have any questions, contact E-Verify at 888-464-4218.

Employer	
Name (Please Type or Print)	
Title	
Signature	
Date	
Department of Homeland Security – Verification Division	
Name (Please Type or Print)	
Title	
Signature	
Date	

Information Required for the E-Verify Program

Information relating to your Company:

Company Name:	
Company Facility Address:	
Company Alternate Address:	
County or Parish:	
Employer Identification Number:	



Company ID Number:

North American Industry Classification Systems Code:	
Administrator:	
Number of Employees:	
Number of Sites Verified for:	1
Are you verifying for more than 1 site? If yes, please provide the number of sites verified for in each State:	
.	

Information relating to the Program Administrator(s) for your Company on policy questions or operational problems:

Name:		Fax Number:	
Telephone Number:			
E-mail Address:			

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 1: GENERAL REQUIREMENTS
Section 01 10 00: Summary of Work

PART 1 - GENERAL

1.1 SECTION INCLUDES:

- A. General Scope of Work
- B. Work By Owner
- C. Contractor Use of Site and Premises
- D. Work Sequence
- E. Scheduling of Work
- F. Grades, Lines and Levels
- G. Reference Standards and Industry Specifications
- H. Application of Documents
- I. Material and Workmanship
- J. Minimum Work Requirements
- K. Jurisdiction of Work
- L. Acceptance of Preceding Work
- M. Damage to Other Work
- N. Safety and Health Requirements
- O. Broken Glass
- P. Cleanup
- Q. Publicity

1.2 GENERAL SCOPE OF WORK

- A. The intent and meaning of the Contract Documents is that the Contractor shall provide labor, plant, materials, supplies, equipment, transportation facilities and appurtenances thereto which are indicated or reasonably implied by the Drawings and Specifications to provide a complete and functional facility.

This Contractor is responsible for their clean up and project security at all affected levels and elsewhere as required and as outlined in detail hereinafter.

- B. Work to be done:

The Contractor will complete the total scope of work for this project to:

Project involves construction of an addition and renovations to house Mental Health and Medical Operations at the Calhoun County Jail Facility. Contractor lay down area will be on site at the location determined at the Pre-Bid Conference and in coordination with the Architect. Note: This area will be maintained and restored as required at the end of construction. This portion of the site will not be occupied during the construction activities. The Jail itself will be operational and fully functional throughout this construction project. The contractor will be required to complete any phasing associated with this project with respect to Bid Items and occupancy. Protection, clean up, and maintenance of the city streets and services as well as County, City, or private property is required by this contract. Abuse of local access/streets and services will be remediated by this contractor at no cost to the Owner. This project consists of Three Bid Items to include the following general classifications of work:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

The Contractor will complete the total scope of work for this project as follows with three (3) separate Bid Items as identified below. All Bid Items will be awarded to a single contractor with the lowest total of all three (3) separate bid items. The project is organized in three separate bid items to facilitate financial management of the project for the Owner and the Design Team. All Pay Requests and other financial components will be organized into three (3) separate project Bid Item components with a complete 17 Division breakdown for each evaluation.

BID ITEM SCHEDULE

Bid Item A – Site work

This Bid Item will be funded through the available IAC funds for this project and will be managed totally separately to accommodate all IAC / ARPA criteria and contract documents.

This Bid Item includes all site/horizontal construction to include site demolition, clearing and grubbing, undercut, controlled fill and backfilling, construction of building pad, all rough and fine grading, all underground utilities including domestic and fire water, sanitary sewer, gas, storm drainage, etc as shown on drawings.

This Bid Item will not include cost of deep foundations, security fencing / gates or finished concrete paving. These elements will be included in Bid Item B.

This Bid Item is included for funding source qualification and does not establish any separation of responsibilities or scopes within and between all trades with respect to providing a complete fully operational facility.

Bid Item B – Remainder of project excluding Bid Item C

All remaining vertical building construction as shown on drawings to include deep foundations, horizontal paving, all structure, finishes, equipment / security systems, and all building systems as shown on drawings and specified herein with the exception of HVAC and Electrical systems required to be furnished under Bid Item C. This bid item will be funded under local funding requirements as outlined herein and are not subject to any of the limitations, criteria or contract parameters pursuant to IAC/ARPA funding.

Bid Item C- HVAC & Electrical work supporting HVAC

This Bid Item will be funded through the available IAC funds for this project and will be managed totally separately to accommodate all IAC / ARPA criteria and contract documents.

This Bid Item includes all HVAC components and systems required to provide a complete HVAC Installation as identified on the drawings to include all electrical systems, controls and interface, etc. to support the HVAC installation and operations. This Bid Item is included for funding source qualification and does not establish any separation of responsibilities or scopes within and between all trades with respect to providing a complete fully operational facility.

Contractor is required to provide full time supervision for this project. This supervision shall be performed by a superintendent who is a full time employee of the Precast Module

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

General Contractor/Vendor and is on site at all times while module installation is underway. No work shall be performed by a Subcontractor unless the Project Superintendent is present.

CIVIL SUMMARY OF WORK:

The Mental Health Medical Unit expansion is being added to the West side of the existing Calhoun County Jail Facility. The facility is located at 400 W 8th Street Building 2, Anniston Alabama 36201. The expansion will include 520 linear feet of sewer main extension, 770 linear feet of new water service line, 390 linear feet of fire protection line, 556 linear feet of storm drainage network, and earthwork to accommodate the 7500 SF expansion. Approximately 2 feet of undercut is required to be removed under the expansion and replaced with borrow material. There will be approximately 0.45 ac of disturbance.

All proposed lines & grades and elevations shown on plans represent final top of grade upon completion of all building and site construction.

A geotechnical report is available for this site and included within the project manual for the contractor's reference.

Any and all erosion control measures shown on plans, or determined to be necessary during construction, is the complete responsibility of the contractor at no additional costs. Contractor to include all erosion control costs, submittal costs, and fees in the bid and familiarize himself with the site in helping to determine all necessary erosion control measures.

Any conflicts between the Drawings and Specifications shall be verified prior to proceeding with the work. In the event of any conflicts, all Bids and pricing shall be based upon the **more stringent** requirement unless written clarification has been received by the Owner allowing otherwise.

Contractor will fine grade and provide topsoil and hydroseeding in all disturbed areas, assure positive drainage in all proposed ditches, and clean and remove all sediment in proposed storm drainage pipes.

STRUCTURAL SUMMARY OF WORK:

The proposed structural scope of this project includes a two-story addition to the existing Calhoun County Jail Facility in Anniston, Alabama. The primary structural system for the addition consists of a combination of precast detention modules, load bearing masonry, cast-in-place elevated slabs, and precast hollow-core roof panels. The foundation system for the addition consists of shallow foundations bearing on improved soils via a delegated design aggregate pier system. The first-floor slab will be a fiber-reinforced slab on grade system bearing on an engineered fill material per the Geotechnical report.

A portion of the existing jail facility will require that the roof framing be demolished to house new mechanical and electrical equipment on an elevated concrete slab. A new retrofit roof system will be added over the entirety of the new addition and the area of the existing facility where the existing roof was demolished. The retrofit roof system will be a delegated design system that will bear on the new hollow-core roof panels over the new addition, and on the existing framing over the existing low roof space.

There will be exercise yards at the first floor consisting of precast structural panels on a shallow foundation system on improved soils via aggregate piers. The ceiling of the exercise yards consists of a structural steel frame which supports security screen.

MECHANICAL SUMMARY OF WORK

1. The work involves all construction required to complete the project as shown on the plans and specifications. Work shall include repair to any building components including walls, roof, ceilings, floor, etc. which may become damaged during the construction. Any needed repair shall be complete and shall be sufficient to return the items to pre-damage condition.
2. Work includes HVAC, plumbing, and fire sprinkler as shown on the plans and specifications.
3. Bid Items for the work shall be as noted on the architectural plans and specifications. Reference Architectural plans and specifications for complete descriptions of alternates, unit pricing, etc.
4. **HVAC:** Work includes installation of new split system heat pumps, variable refrigerant flow systems, energy recovery units, exhaust fans, duct, etc. as necessary to accommodate installation as shown on the plans and specifications.
Bid Item C: All HVAC work shall be in Bid Item C.
Bid Item C, Alternate 2: All HVAC work associated with this Bid Item. Reference plans for additional information.
5. **Plumbing:** Work includes all work as required to complete the new installation as per plans and specifications. Work includes furnishing and installation of new plumbing piping, equipment, etc. as shown on the plans and specifications. All plumbing water piping shall be insulated including piping within the cell module chases. All insulation (furnishing and installing) shall be the responsibility of the plumbing sub-contractor.
Bid Item B: All plumbing work except condensate piping shall be in Bid Item B. Base Bid shall include rough in for area included within Alternate #2. Reference plans for additional information.
Bid Item B, Alternate 2: All plumbing work associated with this Bid Item. Reference plans for additional information.
Bid Item C: Condensate piping shall be in Bid Item C.
6. **Fire Sprinkler:** Work includes new fire sprinkler system in accordance with NFPA 13 and 2021 IFC as per plans and specifications. All sprinkler heads base bid and alternate shall be institutional sprinkler heads.
Bid Item B: All fire sprinkler work shall be in Bid Item B. Base Bid shall include exposed ceilings for area included within Alternate #2. Reference plans for additional information.
Bid Item B, Alternate 2: Ceilings in this area change under Alternate 2. Reference plans for additional information.

ELECTRICAL SUMMARY OF WORK

Please note that the electrical contractor is responsible for all work required by division 26 specifications and all work shown on all "E" Series drawings. The security contractor is responsible for all work required by division 28 specifications and all work shown on all "ES" Series drawings.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

QUALIFICATIONS OF ELECTRICAL CONTRACTORS:

Electrical contractor must be properly established as an electrical contractor by the State of Alabama. Electrical contractor shall have had previous experience in the satisfactory installation of at least three of buildings of this type and size in the State of Alabama.

DESCRIPTION OF WORK:

- A. Execute all work so as to present a neat and workmanlike appearance when completed.
- B. Furnish all labor and materials required to complete the electrical work indicated on the drawings or herein specified.
- C. Provide submittals on construction material as called for in Section 260000.
- D. Remove or relocate all electrical or electronic services located on or crossing through the project property, either above or below grade, which would obstruct the construction of the project or conflict in any manner with the complete project or any code pertaining thereto.
- E. Electrical contractor shall run all raceways as to not jeopardize the integrity of the building structure system. The electrical contractor must have the approval of the architect and structural engineer prior to installing any material that could jeopardize the integrity of the building structure system. Any material or raceways installed in these areas will have to be relocated and the areas fixed at the cost of the contractor.
- F. The Electrical Contractor shall be responsible for furnishing and installing equipment and materials necessary for providing electrical power and lighting where needed for the construction of the project.
- G. Furnish and install a complete electrical light and power system including but not limited to the connection of all switchboards, buss ducts, panelboards, circuit breakers, power outlets, convenience outlets, lighting fixtures, switches, and/or other equipment forming part of the electrical system.
- H. Furnish and install a complete system of outlet boxes, face plates, conduit raceways, J-Hooks, backboard, and service conduit for the communications system.
- I. Furnish and install a complete system of outlet boxes, face plates, conduit raceways, backboard, and service entrance conduit for the security system.
- J. Connect all electrical equipment whether furnished by this contractor or by others.
- K. Furnish and install all disconnect switches not included as an integral part of equipment.
- L. Furnish and install a complete Lighting Control System as indicated on the drawings and specified.
- M. Furnish and install all conduits, cable and connections necessary for a complete Jail Control System. The electrical contractor shall work with the jail controls contractor to ensure all equipment, cable, conduit, etc. is in place to facilitate the work required by the jail control contractor.
- N. Furnish and install a complete paging system.
- O. Furnish and install a complete voice evac type Fire Alarm System as indicated on the drawings.
- P. Furnish and install a complete telephone and communications system. System to include all station/copper cables, conduit, j-hooks, racks, cable management, fiber optic cables, fiber and copper patch panes, switches, etc. Specifications for communications equipment and cables are indicated on drawings. No alternate equipment manufacturers will be accepted unless approved by owner. If there are no other manufacturers listed on the drawings for a particular component then the specifications shall govern. Installation shall be as described in the communications specifications.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- Q. Furnish and install a conduit and raceway system for CCTV systems as defined by the jail control and security systems. Coordinate with jail control system installer to determine the extent of work required.
- R. Furnish and Install a complete raceway and junction box system for inmate phone system. Coordinate with inmate phone system installer to determine the extent of work required.
- S. Furnish and install a complete raceway and power system for video visitation system. Coordinate with video visitation system installer to determine the extent of work required.
- T. Furnish and install a complete power system including all conduit, cabling, junction boxes, outlets etc.
- U. Furnish and install a complete lighting system including all luminaires, switches, conduit, wire, etc. Coordinate with jail control system and interface with jail control relay cabinets where required.
- V. Procure and pay for permits and certifications as required by local and state ordinances and Fire Underwriters certificate of inspection.
- W. Furnish and install a complete emergency power system including engine/generator, transfer switches, conduit, cable, junction boxes, circuit breakers and safety switches.
- X. Visit the site and determine conditions that affect this contract. Failure to do so will in no way relieve the Contractor of his responsibility under his contract.
- Y. Coordinate with Troy Utilities for electrical service for the building.
- Z. Submit to the Architect a certificate of final inspection from local and/or state inspection authorities.
- AA. Establish and maintain temporary electrical services for construction purposes.
- BB. Schedule work as necessary to cooperate with other trades, Do not delay other trades. Maintain necessary competent electricians and supervision to provide an orderly progression of the work.
- CC. During the progress of work, keep the Owner's premises in a neat and orderly condition, free from accumulation of debris resulting from this work. At the completion of the work, remove all material, scrap, etc. not a part of this Contract.
- DD. Upon completion of the work, conduct a thorough test in the presence of Architect or his representative, and demonstrate that all systems are in perfect working condition.
- EE. The contractor shall have all systems ready for operation and an electrician available to remove panel fronts, cover plates, fixture doors, etc., at the final inspection and any other scheduled inspections.
- FF. By on-off, stop-start operation, demonstrate to the Owner or his representative, the use, working, resetting, and adjusting of each and every system. Submit statement initialed by the Owner that such demonstration has been made.

1.3 WORK BY OWNER:

- A. Any items indicated on the Drawings as (NIC) not in contract shall be furnished and installed by the Owner.
- B. Work by Others: The Owner reserves the right and has let other contracts for additional work that may be required in connection with this project. There shall be complete cooperation between and among all Bid Package contractors as well as between this Contractor and all Bid Package Subcontractors to ensure satisfactory progress and performance of the work.

1.4 CONTRACTOR USE OF SITE AND PREMISES

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

The Contractor may work with arrangements as approved by the Owner on the immediate site as necessary to complete the work per the Milestone Dates established. The General Contractor is responsible for all safety measures associated with the work and access to the work under this contract.

1.5 WORK SEQUENCE

- A. Perform all work in not more than 450 calendar days following the Notice To Proceed (NTP) or as determined by the Master Schedule.
 - 1. Contract Time begins at NTP. The Contractor has 10 calendar days from the NTP to begin work at their plant or place of manufacture.
 - 2. The Contractor has 60 calendar days, from NTP to provide all submittals, shop drawings, etc. to Architect for review.
- B. In certain circumstances the Owner may impose a "No Later Than" (NLT) completion date on a project.
 - 1. The Bid Form will acknowledge the NLT date.
 - 2. The Bid Form will include the sub-paragraph number, from paragraph A (above), to which the NLT date will apply, for example "The NLT date applies to completion of Section 1.5 A. (4, 5, or 6)". All later sub-paragraphs, if any, will still apply.
 - 3. If the NLT date is for Sections 1.5 A. 4. or Section 1.5 A. 5., then the time limits in the following sub-paragraphs of Section 1.5 A. still apply, with their time limit(s).

1.6 SCHEDULING OF WORK

- A. Before any work within the scope of the Contract has begun on site, the Contractor shall confer with the Architect and Owner and agree on:
 - 1. Means of access and egress to the required areas in use
 - 2. Space for temporary storage of materials and equipment
 - 3. Use of approaches
 - 4. Similar means of communication
- B. As provided in the documents and in no case later than the preconstruction meeting, the Contractor shall submit a "work schedule" in a form having sufficient detail and character as approved by the Architect. At a minimum the schedule shall illustrate the following:
 - 1. Each task should be indicated in bar format with a timeline in weekly periods, including lead time for major equipment deliveries. Indicate total man-hours to accomplish each task.
 - 2. Each task should be shown indicating the starting period and ending period of that operation. Non-continuous operations shall be so indicated.
 - 3. Completion of each task should conform to agreed upon milestone dates. Interface with contiguous trade activities must be integrated to coincide with milestone dates.
 - 4. The schedule shall be updated and submitted bi-weekly to the Architect. Failure to submit an updated schedule may result in a delay of payment.
- C. The project schedule will be created with the schedules submitted by the General Contractor in combination with the review of the work sequencing. The scheduling process

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

will include a work session to provide for input from each Subcontractor.

- D. The Contractor shall so prosecute their work that they may not only maintain their progress in accordance with the Master Project Schedule but also shall cause no delays to others engaged on the project.
- E. Should the Contractor, either in person or through his agents, fail to maintain their progress according to the established Project Master Schedule, they shall furnish additional labor and/or services as may be necessary to bring their operations up to the Project Schedule.
- F. If the Contractor or his agents have installed their work in a manner or at such a time as to prevent another contractor from installing his work, they shall remove such work and reinstall it at a proper time without additional cost to the Owner.
- G. If necessary, in order to complete the work by the dates specified or to complete any portion of the work in its various stages in time to avoid delaying the Project Schedule, the Contractor shall resort to overtime without additional cost to the Owner.

1.7.1 GRADES, LINES AND LEVELS

- A. The Contractor shall lay out their work and establish lines and levels. The Contractor shall verify measurements at the site before manufacturing and shipping of modules to the project site. No extra charge or compensation is allowed on account of differences between actual dimensions and measurements indicated on drawings. Submit any differences to the Architect for clarification before proceeding.

1.8 REFERENCE STANDARDS AND INDUSTRY SPECIFICATIONS

- A. Any material or operation specified by reference to published specification, manufacturer, society, association, code or other published standard shall comply with requirements of the listed document which is current sixty (60) days prior to the date of receipt of bids. In case of a conflict between referenced document and the Specifications, the Specifications shall govern.

1.9 APPLICATION OF DOCUMENTS

- A. In the absence of any specific instruction or specification, employ workmanship and material approved by Architect with quality equal to that in the Contract Documents and/or by industry Standards and Criteria.
- B. Specification Sections are not intended to divide work responsibilities among various Subcontractors to the module manufacturer.
- C. Division 1 Sections apply to all Sections.
- D. The Project Manual consists of the Owners Bidding Documents, Conditions of the Contract, and Specifications
- E. The Drawings indicate the general design and arrangement of equipment, apparatus, fixtures, accessories etc., necessary to complete the installation of systems. The exact location or arrangement of apparatus and equipment, unless otherwise dimensioned, is subject to minor changes necessitated by field conditions and shall be verified by actual observation at the construction site. The Contractor shall be responsible to ensure his work fits into place in a satisfactory and workmanlike manner and to the Architect's

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

approval and meets all applicable code and manufacturers' criteria and is fully coordinated with Owner's General Contractor.

- F. Manufacturers listed in each Section of the Specifications are considered as acceptable insofar as they meet the requirements of the Specifications. Each respective Section is written using products of the first mentioned manufacturer.
- G. The Contractor shall be responsible for coordinating for all trades and all activities at the plant and on site. No extra payments will be made for the cost of removing and relocating equipment or work found to be encroaching on space required by others if uncoordinated.
- H. Mention of a particular product or products of one or more manufacturers is not intended to preclude the possible use of equivalent products of other listed manufacturers. The products specifically mentioned are cited to establish, as definitely as practical, the required characteristics, function, quality, size, gauges, grades, colors, etc. of the item concerned. Further approval is not necessary for those items designated by trade names.

1.10 MATERIAL AND WORKMANSHIP

- A. The Contractor and each of its Subcontractors are responsible for damages caused by his work or employees to adjoining property, existing facilities, present work and work installed by him or others.
- B. The workmanship of trades shall be the best obtainable, and materials shall be installed true to line, level, plumb and dimension.
- C. Any materials, manufactured articles or equipment which may affect the architectural aspect or appearances of the work shall be subject to the express approval of the Architect, and should such work be rejected for appearance reasons, the Contractor shall remove and replace at his own expense and replace with materials, etc. to the satisfaction of the Architect.
- D. Manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the appropriate manufacturer, unless herein specified to the contrary.

1.11 MINIMUM WORK REQUIREMENTS

- A. Technical requirements and methods of operation and procedures specified under indexed sections of these construction specifications constitute minimum requirements. Manufacturer's guarantees and agreements shall be observed, in effect and valid.

1.12 JURISDICTION OF WORK

- A. When the completion of the Work requires the Contractor to furnish labor and materials at their plant or at the site other than that which is generally accepted by trade or branch of work, that Contractor shall sublet same to a party engaged in that trade or branch of work and notify the Architect of the same.

1.13.1.1 ACCEPTANCE OF PRECEDING WORK

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Before starting any setting operation, the Contractor and each Subcontractor shall examine work performed by others to which his work adjoins or is applied and shall remedy or report to the Architect conditions that will prevent satisfactory accomplishment of his contract. Failure to notify the Architect in writing of deficiencies or faults in preceding work will constitute acceptance thereof and waiver of any claim of its unsuitability.

1.14 DAMAGE TO OTHER WORK

- A. The Contractor and each Subcontractor are responsible for damage caused by his work or employees to adjoining property, existing facilities, present work and work installed by him or others.
- B. It is the responsibility of the Contractor and each Subcontractor to make a report immediately to the Architect if a utility line or source of any kind is encountered unexpectedly, and to protect and maintain it until instructions for its disposal can be issued.

1.15 SAFETY AND HEALTH REQUIREMENTS

- A. The Contractor and each Subcontractor acknowledge their obligation to comply with applicable federal, state and local acts and regulations and without limiting this obligation, and in addition to other indemnities provided for in this contract, agree to comply with the Occupational Health and Safety Act of 1970 (OSHA) onsite and at the place of manufacture.

1.16 CLEANUP

- A. The Contractor shall keep the work area reasonably clean and free of debris. Each Contractor shall clean up debris on a daily basis and place it in his designated dumpster.

1.17 PUBLICITY

- A. Any publicity giving reference to this project, whether in the form of press releases, brochures, photographic coverage, or verbal announcement shall be only with the general or specific approval of the Owner, and in all instances shall give due mention of the Architect, the Architect's consultants, and the Owner.

END OF SECTION 01 10 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 01: GENERAL REQUIREMENTS

Section 01 21 00: Base Bid, Allowances and Unit Prices

1. BASE BID: SEE SUMMARY OF WORK

- A. Scope of Work: The Work will be constructed under a general contract with all trades included, in accordance with the Contract Documents.

The Contractor shall execute the work in accordance with the true intent of the Contract Documents, which is to effect a complete, coordinated, operational, useable, first-class job without additional cost to the Owner, whether or not each and every item necessary therefore is specifically mentioned. Omissions, mis-descriptions, and conflicts in or between specifications and drawings (and not clarified prior to bidding) will not relieve the Contractor from performing any work necessary to such completion.

The General and other Conditions and all other Contract Documents are applicable to all work under Divisions of the Specifications.

Note: All Allowances and Unit Prices shall include all labor, materials, overhead and profit.

The Base Bid will include all work shown on the drawings.

Contractor shall follow what is required in the bid documents regarding markups being included in all unit prices. The owner will not allow markups on any work that is added by unit prices.

Owner will award the project to the lowest responsive base bidder which includes all bid items on the bid proposal form. In the event after award a bid item is deducted then the owner will follow the contract documents regarding deductive change orders.

BID ITEM SCHEDULE

Bid Item A – Site work

This Bid Item will be funded through the available IAC funds for this project and will be managed totally separately to accommodate all IAC / ARPA criteria and contract documents.

This Bid Item includes all site/horizontal construction to include site demolition, clearing and grubbing, undercut, controlled fill and backfilling, construction of building pad, all rough and fine grading, all underground utilities including domestic and fire water, sanitary sewer, gas, storm drainage, etc as shown on drawings.

This Bid Item will not include cost of deep foundations, security fencing / gates or finished concrete paving. These elements will be included in Bid Item B.

This Bid Item is included for funding source qualification and does not establish any separation of responsibilities or scopes within and between all trades with respect to providing a complete fully operational facility.

Bid Item B – Remainder of project excluding Bid Item C

All remaining vertical building construction as shown on drawings to include deep foundations, horizontal paving, all structure, finishes, equipment / security systems, and all building systems as shown on drawings and specified herein with the exception of HVAC and Electrical systems required to be furnished under Bid Item C. This bid item

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

will be funded under local funding requirements as outlined herein and are not subject to any of the limitations, criteria or contract parameters pursuant to IAC/ARPA funding.

Bid Item C- HVAC & Electrical work supporting HVAC

This Bid Item will be funded through the available IAC funds for this project and will be managed totally separately to accommodate all IAC / ARPA criteria and contract documents.

This Bid Item includes all HVAC components and systems required to provide a complete HVAC Installation as identified on the drawings to include all electrical systems, controls and interface, etc. to support the HVAC installation and operations. This Bid Item is included for funding source qualification and does not establish any separation of responsibilities or scopes within and between all trades with respect to providing a complete fully operational facility.

2. ALLOWANCES

The allowances shall be included in the Base Bid.

A. Each bidder shall include in their proposal the following allowances:

1. **N/A**

B. Unit Price is an amount proposed by bidders, stated on the Bid Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

C. Unit Prices include all necessary material, plus cost of delivery, installation, insurance, applicable taxes, overhead and profit.

D. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and have this work measured, at Owner's expense, by an independent surveyor acceptable to the Contractor.

E. List of Unit Price:

END OF SECTION 01 21 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 1: GENERAL REQUIREMENTS
Section 01 23 00: Alternates

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for Alternates.
- B. Definition: An Alternate is an amount proposed by Bidders and stated on the Bid Form for certain construction activities defined in the Bidding Requirements that may be added to or deducted from Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems or installation methods described in Contract Documents.
- C. Coordination: Coordinate related Work and modify or adjust adjacent Work as necessary to ensure that Work affected by each accepted Alternate is complete and fully integrated into the project.
- D. Notification: Immediately following the award of the Contract, prepare and distribute to each party involved, notification of the status of each Alternate. Indicate whether Alternates have been accepted, rejected, or deferred for consideration at a later date. Include a complete description of negotiated modifications to Alternates.
- E. Schedule: A "Schedule of Alternates" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials and methods necessary to achieve the Work described under each Alternate.
 - 1. Include as part of each Alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not mentioned as part of the Alternate.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

BID ITEM B – ALTERNATE NO. 1: Each bidder shall include on their proposal the cost including material, labor, taxes, material, labor, taxes, overhead, profit, etc. as an Alternate Price for GENERATOR.

BID ITEM B – ALTERNATE NO. 2: Each bidder shall include on their proposal the cost including material, labor, taxes, material, labor, taxes, overhead, profit, etc. as an Alternate Price for MALE AND FEMALE MEDICAL EVALUATION BEDS SECOND FLOOR.

BID ITEM B - ALTERNATE NO. 3: Each bidder shall include on their proposal the cost including material, labor, taxes, material, labor, taxes, overhead, profit, etc. as an Alternate Price for CAMERAS IN CELLS

BID ITEM B - ALTERNATE NO. 4: Each bidder shall include on their proposal the cost including material, labor, taxes, material, labor, taxes, overhead, profit, etc. as an Alternate Price for TELEMEDICINE

END OF SECTION 01 23 00

ALTERNATES

01 23 00 - 1

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 1: GENERAL REQUIREMENTS
Section 01 31 00: Project Coordination

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.02 PROJECT SUPERINTENDENT

- A. The CONTRACTOR shall employ and designate a well-qualified and experienced Superintendent for the duration of the project. The Superintendent shall be designated in writing to the OWNER within fourteen (14) days following the Notice of Award. The designated person shall be the point of contact for the ARCHITECT and his RESIDENT OBSERVER for the duration of the contract.

1.03 PROJECT SCHEDULES

- A. Each CONTRACTOR shall submit, acceptable to the OWNER, a proposed schedule for the project. The schedule shall be delivered to the OWNER, through the ARCHITECT / PROJECT ENGINEER, no later than fourteen (14) days following the Notice of Award. Revised acceptable Project Progress Schedules shall be submitted by the CONTRACTOR when specifically requested by the OWNER.

1.2 SUMMARY

- A. This Section specifies administrative and supervisory requirements necessary for Project coordination including, but not necessarily limited to:
 - 1. Coordination.
 - 2. Administrative and supervisory personnel.
 - 3. General installation provisions.
 - 4. Cleaning and protection.
- B. Field engineering is included in Section "Field Engineering".
- C. Progress meetings, coordination meetings and pre-installation conferences are included in Section "Project Meetings".
- D. Requirements for the Contractor's Construction Schedule are included in Section "Submittals".

1.3 COORDINATION

- A. Coordination: Coordinate construction activities included under various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specifications that are dependent upon each other for proper installation, connection, and operation.
 - 1. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.
 - 2. Where availability of space is limited, coordinate installation of different components to

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. assure maximum accessibility for required maintenance, service and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
 1. Prepare similar memoranda for the Owner and separate Contractors where coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 1. Preparation of schedules.
 2. Installation and removal of temporary facilities.
 3. Delivery and processing of submittals.
 4. Progress meetings.
 5. Project Close-out activities.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
 1. Salvage materials and equipment involved in performance of, but not actually incorporated in, the Work. Refer to other sections for disposition of salvaged materials that are designated as Owner's property.

1.4 SUBMITTALS

- A. Coordination Drawings: Submittals shall be delivered to the ARCHITECT / PROJECT ENGINEER in accordance with Section 01 33 00 no later than five (5) days following the Notice of Award. Due to the critical time factor of the project, CONTRACTOR shall require that all manufacturers carefully prepare their submittals and indicate all details needed to confirm compliance with the Contract Documents. The CONTRACTOR shall carefully review, check and coordinate every submittal prior to submission. Prepare and submit coordination Drawings where close and careful coordination is required for installation of products and materials fabricated off-site by separate entities, and where limited space availability necessitates maximum utilization of space for efficient installation of different components.
 1. Show the interrelationship of components shown on separate Shop Drawings.
 2. Indicate required installation sequences.
 3. Comply with requirements contained in Section "Submittals."
 4. Refer to Division-15 Section "Basic Mechanical Requirements," and Division-16 Section "Basic Electrical Requirements" for specific coordination Drawing requirements for mechanical and electrical installations.
- B. Staff Names: Within 14 days of Notice of Award, submit a list of the Contractor's principal staff assignments, including the Superintendent and other personnel in attendance at the site; identify individuals, their duties and responsibilities; list their addresses and telephone numbers.
 1. Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

PART 2 – MATERIALS

2.01 Storage:

- A. The CONTRACTOR shall acquire a suitable storage facility for the storage of all materials. It shall be the sole responsibility of the CONTRACTOR to secure all storage of materials whether onsite or offsite. Storage areas shall be accessible to Resident Observer at all times. Storage shall be in accordance with the manufacturer's requirements. No storage of materials on public right of way shall be permitted.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION PROVISIONS

- A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.
- C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
- D. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.
- E. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.
- F. Recheck measurements and dimensions, before starting each installation.
- G. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.
- H. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.
- I. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect for final decision.

3.2 CLEANING AND PROTECTION

- A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

C. Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:

1. Excessive static or dynamic loading.
2. Excessive internal or external pressures.
3. Excessively high or low temperatures.
4. Thermal shock.
5. Excessively high or low humidity.
6. Air contamination or pollution.
7. Water or ice.
8. Solvents.
9. Chemicals.
10. Light.
11. Radiation.
12. Puncture.
13. Abrasion.
14. Heavy traffic.
15. Soiling, staining and corrosion.
16. Bacteria.
17. Rodent and insect infestation.
18. Combustion.
19. Electrical current.
20. High speed operation,
21. Improper lubrication,
22. Unusual wear or other misuse.
23. Contact between incompatible materials.
24. Destructive testing.
25. Misalignment.
26. Excessive weathering.
27. Unprotected storage.
28. Improper shipping or handling.
29. Theft.
30. Vandalism.

END OF SECTION 01 31 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 1: GENERAL REQUIREMENTS
Section 01 31 19: Project Meetings

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for project meetings including but not limited to:
 - 1. Pre-Construction Conference.
 - 2. Pre-Installation Conferences.
 - 3. Coordination Meetings.
 - 4. Progress Meetings.
 - 5. Project Closeout Meeting
- B. Construction schedules are specified in another Division-1 Section.

1.3 PRE-CONSTRUCTION CONFERENCE

- A. Schedule a pre-construction conference and organizational meeting at the Project site or other convenient location no later than 15 days after execution of the Agreement and prior to commencement of construction activities. Conduct the meeting to review responsibilities and personnel assignments.
- B. Attendees: The Owner, Architect and their consultants, the Contractor and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the Work.
- C. Agenda: Discuss items of significance that could affect progress including such topics as:
 - 1. Tentative construction schedule.
 - 2. Critical Work sequencing.
 - 3. Designation of responsible personnel.
 - 4. Procedures for processing field decisions and Change Orders.
 - 5. Procedures for processing Applications for Payment.
 - 6. Distribution of Contract Documents.
 - 7. Submittal of Shop Drawings, Product Data and Samples.
 - 8. Preparation of record documents.
 - 9. Use of the premises.
 - 10. Office, Work and storage areas.
 - 11. Equipment deliveries and priorities.
 - 12. Safety procedures.
 - 13. First aid.
 - 14. Security.
 - 15. Housekeeping.
 - 16. Working hours.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1.4 PRE-INSTALLATION CONFERENCES

A. Conduct a pre-installation conference at the site before each construction activity that requires coordination with other construction. The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise the Architect of scheduled meeting dates.

1. Review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for:

- a. Contract Documents.
- b. Options.
- c. Related Change Orders.
- d. Purchases
- e. Deliveries.
- f. Shop Drawings, Product Data and quality control Samples.
- g. Possible conflicts.
- h. Compatibility problems.
- i. Time schedules.
- j. Weather limitations.
- k. Manufacturer's recommendations.
- l. Compatibility of materials.
- m. Acceptability of substrates.
- n. Temporary facilities.
- o. Space and access limitations.
- p. Governing regulations.
- q. Safety.
- r. Inspection and testing requirements.
- s. Required performance results.
- t. Recording requirements.
- u. Protection.

2. Record significant discussions and agreements and disagreements of each conference, along with the approved schedule. Distribute the record of the meeting to everyone concerned, promptly, including the Owner and Architect.

3. Do not proceed if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

4. Required Meetings include, but are not limited to :

Site work
Utilities
Concrete
Masonry
Structural Steel
Metal Fabrications
Detention Modules
Stairs, Handrails, and Railings
Finish Carpentry
Interior Architectural Millwork
Building Insulation

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

EIFS
Metal Wall Panels
TPO Roofing System
Firestopping
Joint Sealants
Steel Doors and Frames
Wood Doors
Glazing
Aluminum Storefront and Openings
Gypsum Board Assemblies
Tile
Acoustical Panel Ceilings
Resilient Flooring and Base
Carpet
Painting
Elastomeric Coating
Signage
Toilet and Bath Accessories
Protective Covers
Residential Appliances
Irrigation
Architectural Cast Stone
Exterior Sheathing and Moisture Barrier
Fire Suppression
Plumbing
Electrical
Heating, Ventilation, and Air Conditioning
Electronic Security
Data / IT

1.5 COORDINATION MEETINGS

- A. Conduct Project coordination meetings at regularly scheduled times convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special pre-installation meetings.
- B. Request representation at each meeting by every party currently involved in coordination or planning for the construction activities involved.
- C. Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.6 PROGRESS MEETINGS

- A. Conduct progress meetings at the Project site with Owner's Schedule Consultant at bi-weekly intervals. Notify the Owner and Architect of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request.
- B. Attendees: In addition to representatives of the Owner, Architect and Schedule Consultant each subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at these meetings by persons familiar with the Project and authorized to conclude matters relating to progress.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.
1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 2. Review the present and future needs of each entity present, including such items as:
 - a. Interface requirements.
 - b. Time.
 - c. Sequences.
 - d. Deliveries.
 - e. Off-site fabrication problems.
 - f. Access.
 - g. Site utilization.
 - h. Temporary facilities and services.
 - i. Hours of Work.
 - j. Hazards and risks.
 - k. Housekeeping.
 - l. Quality and Work standards.
 - m. Change Orders.
 - n. Documentation of information for payment requests.
- D. Reporting: No later than 3 days after each progress meeting date the Schedule Consultant will distribute copies of minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
1. Schedule Updating: The Schedule Consultant will revise the construction near term schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised near term schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 31 19

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 1: GENERAL REQUIREMENTS
Section 01 33 00: Submittals

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for submittals required for performance of the Work, including:
 - 1. Contractor's construction schedule.
 - 2. Submittal schedule.
 - 3. Daily construction reports.
 - 4. Shop Drawings.
 - 5. Product Data.
 - 6. Samples.
- B. Administrative Submittals: Refer to other Division-1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:
 - 1. Permits.
 - 2. Applications for payment.
 - 3. Performance and payment bonds.
 - 4. Insurance certificates.
 - 5. List of Subcontractors.
- C. The Schedule of Values submittal is included in Section "Applications for Payment."
- D. Inspection and test reports are included in Section "Quality Control Services."
- E. Submittal of Project photographs is included under Section "Construction Photographs."

1.3 SUBMITTAL PROCEDURES

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
 - a. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.
 - a. Allow **two weeks** for initial review. Allow additional time if processing must be delayed permitting coordination with subsequent submittals. The Architect will promptly advise the Contractor when a submittal being processed must be delayed for coordination.
 - b. If an intermediate submittal is necessary, process the same as the initial submittal.
 - c. Allow **two weeks** for reprocessing each submittal.
 - d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.

- B. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
 1. Provide a space approximately 4" x 5" on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.
 2. Include the following information on the label for processing and recording action taken.
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name and address of Contractor.
 - e. Name and address of subcontractor.
 - f. Name and address of supplier.
 - g. Name of manufacturer.
 - h. Number and title of appropriate Specification Section.
 - i. Drawing number and detail references, as appropriate.

- C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Architect using a transmittal form. Submittals received from sources other than the Contractor will be returned without action.
 1. On the transmittal Record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.
 2. Transmittal Form: Use AIA Document G 810.
 3. Transmittal Form: Use the sample form at the end of this Section for transmittal of submittals.

1.4 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: The Contractor will prepare a fully developed, horizontal bar- chart type Contractor's construction schedule. Submit within 30 days of the date established for "Commencement of the Work".
 1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated in the "Schedule of Values".
 2. Within each time bar indicate estimated completion percentage in 10 percent increments. As Work progresses, place a contrasting mark in each bar to indicate Actual Completion.
 3. Prepare the schedule on a sheet, or series of sheets, of stable transparency, or other

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- reproducible media, of sufficient width to show data for the entire construction period.
4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the Work.
 5. Coordinate the Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests and other schedules.
 6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architect's procedures necessary for certification of Substantial Completion.
- B. Phasing: Provide notations on the schedule to show how the sequence of the Work is affected by requirements for phased completion to permit Work by separate Contractors and partial occupancy by the Owner prior to Substantial Completion.
- C. Work Stages: Indicate important stages of construction for each major portion of the Work, including testing and installation.
- D. Area Separations: Provide a separate time bar to identify each major construction area for each major portion of the Work. Indicate where each element in an area must be sequenced or integrated with other activities.
- E. Cost Correlation: At the head of the schedule, provide a two-item cost correlation line, indicating "precalculated" and "actual" costs. On the line show dollar-volume of Work performed as of the dates used for preparation of payment requests.
1. Refer to Section "Applications for Payment" for cost reporting and payment procedures.
- F. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the Project meeting room and temporary field office.
1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.
- G. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

1.5 SUBMITTAL SCHEDULE

- A. After development and acceptance of the Contractor's construction schedule, prepare a complete schedule of submittals. Submit the schedule within 10 days of the date required for establishment of the Contractor's construction schedule.
1. Coordinate submittal schedule with the list of subcontracts, schedule of values and the list of products as well as the Contractor's construction schedule.
 2. Prepare the schedule in chronological order; include submittals required during the first 90 days of construction. Provide the following information:
 - a. Scheduled date for the first submittal.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- b. Related Section number.
 - c. Submittal category.
 - d. Name of subcontractor.
 - e. Description of the part of the Work covered.
 - f. Scheduled date for resubmittal
 - g. Scheduled date the Architect's final release or approval.
- B. Distribution: Following response to initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.
1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.
- C. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

1.6 DAILY CONSTRUCTION REPORTS

- A. Prepare a daily construction report, recording the following information concerning events at the site; and submit duplicate copies to the Architect at weekly intervals:
1. List of subcontractors at the site.
 2. Approximate count of personnel at the site.
 3. High and low temperatures, general weather conditions.
 4. Accidents and unusual events.
 5. Meetings and significant decisions.
 6. Stoppages, delays, shortages, losses.
 7. Meter readings and similar recordings.
 8. Emergency procedures.
 9. Orders and requests of governing authorities.
 10. Change Orders received, implemented.
 11. Services connected, disconnected.
 12. Equipment or system tests and start-ups.
 13. Partial Completions, occupancies.
 14. Substantial Completions authorized.

1.7 SHOP DRAWINGS

- A. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.
- B. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:
1. Dimensions.
 2. Identification of products and materials included.
 3. Compliance with specified standards.
 4. Notation of coordination requirements.
 5. Notation of dimensions established by field measurement.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

6. Sheet Size: Except for templates, patterns and similar full- size Drawings, submit Shop Drawings on sheets at least 8-1/2" x 11" but no larger than 36" x 48".
 7. Initial Submittal: Submit one correctable translucent reproducible print and one blue- or black-line print for the Architect's review; the reproducible print will be returned.
 8. Initial Submittal: Submit 2 blue- or black-line prints for the Architect's review; one will be returned.
 9. Final Submittal: Submit 3 blue- or black-line prints; submit 5 prints where required for maintenance manuals. 2 prints will be retained; the remainder will be returned.
 10. Final Submittal: Submit 3 blue- or black-line prints and 2 additional prints where required for maintenance manuals, plus the number of prints needed by the Architect for distribution. 2 prints will be retained; the remainder returned.
 - a. One of the prints returned shall be marked-up and maintained as a "Record Document".
 11. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.
- C. Coordination drawings are a special type of Shop Drawing that show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or function as intended.
1. Preparation of coordination Drawings is specified in section "Project Coordination" and may include components previously shown in detail on Shop Drawings or Product Data.
 2. Submit coordination Drawings for integration of different construction elements. Show sequences and relationships of separate components to avoid conflicts in use of space.

1.8 PRODUCT DATA

- A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawings."
1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:
 - a. Manufacturer's printed recommendations.
 - b. Compliance with recognized trade association standards.
 - c. Compliance with recognized testing agency standards.
 - d. Application of testing agency labels and seals.
 - e. Notation of dimensions verified by field measurement.
 - f. Notation of coordination requirements.
 2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
 3. Preliminary Submittal: Submit a preliminary single-copy of Product Data where selection of options is required.
 4. Submittals: Submit 2 copies of each required submittal; submit 4 copies where required for maintenance manuals. The Architect will retain one and will return the other marked with action taken and corrections or modifications required.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
5. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
 - a. Do not proceed with installation until an applicable copy of Product Data applicable is in the installer's possession.
 - b. Do not permit use of unmarked copies of Product Data in connection with construction.

1.9 SAMPLES

- A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture and pattern.
 1. Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Prepare Samples to match the Architect's Sample. Include the following:
 - a. Generic description of the Sample.
 - b. Sample source.
 - c. Product name or name of manufacturer.
 - d. Compliance with recognized standards.
 - e. Availability and delivery time.
 2. Submit Samples for review of kind, color, pattern, and texture, for a final check of these characteristics with other elements, and for a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
 - a. Where variation in color, pattern, texture or other characteristics are inherent in the material or product represented, submit multiple units (not less than 3), that show approximate limits of the variations.
 - b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation and similar construction characteristics.
 - c. Refer to other Sections for Samples to be returned to the Contractor for incorporation in the Work. Such Samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of Sample submittals.
 3. Preliminary submittals: Where Samples are for selection of color, pattern, texture or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.
 - a. Preliminary submittals will be reviewed and returned with the Architect's mark indicating selection and other action.
 4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit 3 sets; one will be returned marked with the action taken.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

5. Maintain sets of Samples, as returned, at the Project site, for quality comparisons throughout the course of construction.
 - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
 - b. Sample sets may be used to obtain final acceptance of the construction associated with each set.
- B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.
 1. Field Samples specified in individual Sections are special types of Samples. Field Samples are full-size examples erected on site to illustrate finishes, coatings, or finish materials and to establish the standard by which the Work will be judged.
 - a. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

1.10 ARCHITECT'S ACTION

- A. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Architect will review each submittal, mark to indicate action taken, and return promptly.
 1. Compliance with specified characteristics is the Contractor's responsibility.
- B. Action Stamp: The Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:
 1. Final Unrestricted Release: Where submittals are marked "Approved," that part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
 2. Final-But-Restricted Release: When submittals are marked "Approved as Noted," that part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.
 3. Returned for Resubmittal: When submittal is marked "Not Approved, Revise and Resubmit," do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.
 - a. Do not permit submittals marked "Not Approved, Revise and Resubmit" to be used at the Project site, or elsewhere where Work is in progress.
 4. Other Action: Where a submittal is primarily for information or record purposes, special processing or other activity, the submittal will be returned, marked "Action Not Required".

PART 2 - PRODUCTS (Not Applicable).
PART 3 - EXECUTION (Not Applicable).
END OF SECTION 01 33 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 1: GENERAL REQUIREMENTS
Section 01 33 23: Shop Drawings, Product Data and Samples

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for submittal of Shop Drawings, Product Data and Samples to verify that products, materials and systems proposed for use comply with provisions of the Contract Documents.
- B. Shop Drawings include, but are not limited to, the following:
 - 1. Fabrication Drawings.
 - 2. Installation Drawings.
 - 3. Setting diagrams.
 - 4. Shopwork manufacturing instructions.
 - 5. Templates and patterns.
 - 6. Schedules.
 - 7. Design mix formulas.
 - a. Standard information prepared without specific reference to the Project is not considered to be Shop Drawings.
 - 8. Coordination Drawings are a special type of Shop Drawing that show the relationship and integration of different construction elements that require close and careful coordination during fabrication or during installation to fit in the restricted space provided or to function as intended.
 - a. Preparation of Coordination Drawings is specified in the "Project Coordination" Section and may include components previously shown in detail on Shop Drawings or Product Data.
- C. Product Data include, but are not limited to, the following:
 - 1. Manufacturer's product Specifications.
 - 2. Manufacturer's installation instructions.
 - 3. Standard color charts.
 - 4. Catalog cuts.
 - 5. Roughing-in diagrams and templates.
 - 6. Standard wiring diagrams.
 - 7. Printed performance curves.
 - 8. Operational range diagrams.
 - 9. Mill reports.
 - 10. Standard product operating and maintenance manuals.
- D. Samples include, but are not limited to, the following:
 - 1. Partial Sections of manufactured or fabricated components.
 - 2. Small cuts or containers of materials.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Complete units of repetitively-used materials.
 4. Swatches showing color, texture and pattern.
 5. Color range sets.
 6. Components used for independent inspection and testing.
 7. Field Samples are full-size physical examples erected on site to illustrate finishes, coatings, or finish materials and to establish the standard by which the Work will be judged.
 8. Mock-ups are full size assemblies for review of construction, coordination, testing, or operation; they are not Samples.
- E. Administrative Submittals: Refer to other Division-1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:
1. Permits.
 2. Applications for payment.
 3. Performance and payment bonds.
 4. Insurance certificates.
 5. Listing of subcontractors.
- F. Project Photographs: Submittal of Project photographs is included under Section "Construction Photographs."
- G. Inspection and Test Reports: Submittal of inspection and test reports is included under Section "Quality Control Services."
- H. Mock-ups: Erection of mock-ups is included under Section "Quality Control Services."

1.3 SUBMITTAL PROCEDURES

- A. Coordination: Coordinate preparation and processing of submittals with performance of the Work. Transmit each submittal to the Architect sufficiently in advance of scheduled performance of related construction activities to avoid delay.
1. Coordinate each submittal with other submittals and related activities that require sequential activity including:
 - a. Testing.
 - b. Purchasing.
 - c. Fabrication.
 - d. Delivery.
 2. Coordinate transmittal of different types of submittals for the same element of the Work and different elements of related parts of the Work so that processing will not be delayed by the Architect's need to review submittals concurrently for coordination.
 - a. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are forthcoming.
 3. Scheduling: The Submittal Schedule listing submittals and indicating time requirements for coordination of submittal activity with related construction operations is included under Section "Schedules and Reports."
 4. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Allow two weeks for the Architect's initial review of each submittal. Where processing must be delayed to permit coordination with subsequent submittals, allow additional time. The Architect will advise the Contractor promptly when a submittal being processed must be delayed for coordination.
 - b. Where necessary to provide an intermediate submittal between the initial and final submittals, process the intermediate submittal in the same manner as the initial submittal.
 - c. Allow two weeks for reprocessing each submittal.
 - d. Advise the Architect when processing time is critical to progress, and the Work would be expedited if processing time could be shortened.
 - e. No extension of time will be authorized because of the Contractor's failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.
- B. Submittal Preparation: Place a permanent label or title block on each submittal for identification.
1. Indicate the name of the firm or entity that prepared each submittal on the label or title block.
 2. Provide a space approximately 4" x 5" on the label or beside the title block to record the Contractor's review and approval markings and the action taken by the Architect.
 3. Include the following information on the label for processing and recording action taken.
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name and address of Contractor.
 - e. Name and address of subcontractor.
 - f. Name and address of supplier.
 - g. Name of manufacturer.
 - h. Number and title of appropriate Specification Section.
 - i. Drawing number and detail references, as appropriate.
 - j. Similar definitive information as necessary.
- C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Architect, and to other destinations, as indicated, by use of a transmittal form. Submittals received from sources other than the Contractor will be returned to the sender without action.
1. Record relevant information and requests for data on the transmittal form. On the form, or an attached separate sheet, record deviations from requirements of the Contract Documents, including minor variations and limitations.
 2. Include the Contractor's signed certification stating that information submitted complies with requirements of the Contract Documents.
 3. Transmittal Form: Use AIA Document G 810.
 4. Transmittal Form: Use the Sample form included at the end of this Section for transmittal of submittals.
 5. Transmittal Form: Prepare a draft of a transmittal form and submit it to the Architect for acceptance. Provide places on the form for the following information:
 - a. Project name.
 - b. Date.
 - c. Destination (To:).
 - d. Source (From:).
 - e. Names of subcontractor, manufacturer and supplier.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- f. Category and type of submittal.
- g. Submittal purpose and description.
- h. Submittal and transmittal distribution record.
- i. Remarks.
- j. Signature of transmitter.

1.4 SPECIFIC SUBMITTAL REQUIREMENTS

- A. Shop Drawings: Submit newly prepared information, drawn to accurate scale. Do not reproduce Contract Documents or copy standard printed information as the basis of Shop Drawings.
 - 1. Include the following information on Shop Drawings:
 - a. Dimensions.
 - b. Identification of products and materials included.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - 2. Submit Coordination Drawings where required for integration of different construction elements. Show construction sequences and relationships of separate components where necessary to avoid conflicts in utilization of the space available.
 - 3. Highlight, encircle or otherwise indicate deviations from the Contract Documents on the Shop Drawings.
 - 4. Do not permit Shop Drawing copies without an appropriate final stamp or other marking indicating the action taken by the Architect to be used in connection with construction.
 - 5. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2" x 11" but no larger than 30" x 40".
 - 6. Initial Submittal: Submit one correctable translucent reproducible print and one blue- or black-line print for the Architect's review; the reproducible print will be returned.
 - 7. Initial Submittal: Submit 2 blue- or black-line prints for the Architect's review; one will be returned.
 - 8. Final Submittal: Submit 3 blue- or black-line prints; submit 5 prints where prints are required for maintenance manuals. 2 prints will be retained; the remainder will be returned.
 - 9. Final Submittal: Submit 3 blue- or black-line prints; submit 5 prints where prints are required for maintenance manuals, plus the number of prints needed by the Architect for distribution. 2 prints will be retained; the remainder returned.
 - a. One of the prints returned shall be marked-up and maintained by the Contractor as a "Record Document".
- B. Product Data: Collect Product Data into a single submittal for each element of construction or system. Mark each copy to show which choices and options are applicable to the Project.
 - 1. Where Product Data have been printed to include information on several similar products, some of which are not required for use on the Project, or are not included in this submittal, mark copies to clearly indicate which information is applicable.
 - 2. Where Product Data must be specially prepared for required products, materials or systems, because standard printed data are not suitable for use, submit as "Shop Drawings" not "Product Data".
 - 3. Include the following information in Product Data:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Manufacturer's printed recommendations.
 - b. Compliance with recognized trade association standards.
 - c. Compliance with recognized testing agency standards.
 - d. Application of testing agency labels and seals.
 - e. Notation of dimensions verified by field measurement.
 - f. Notation of coordination requirements.
4. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
 5. Preliminary Submittal: Submit a preliminary single copy of Product Data where selection of options by the Architect is required.
 6. Submittals: Submit 2 copies of each required Product Data submittal; submit 2 additional copies where copies are required for maintenance manuals. The Architect will retain one copy, and will return the other marked with the action taken and corrections or modifications required.
 - a. Unless the Architect observes noncompliance with provisions of the Contract Documents, the submittal may serve as the final submittal.
 7. Distribution: Furnish copies of final Product Data submittal to manufacturers, subcontractors, suppliers, fabricators, installers, governing authorities and others as required for performance of the construction activities. Show distribution on transmittal forms.
 - a. Do not proceed with installation of materials, products and systems until a copy of Product Data applicable to the installation is in the installer's possession.
 - b. Do not permit use of unmarked copies of Product Data in connection with construction.
- C. Samples: Submit Samples physically identical with the material or product proposed for use; submit full-size, fully fabricated Samples, cured and finished in the manner specified.
1. Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Prepare Samples to match the Architect's Sample where so indicated. Include the following information:
 - a. Generic description of the Sample.
 - b. Size limitations.
 - c. Sample source.
 - d. Product name or name of manufacturer.
 - e. Compliance with recognized standards.
 - f. Compliance with governing regulations.
 - g. Availability.
 - h. Delivery time.
 2. Submit Samples for review of kind, color, pattern, and texture, for a final check of these characteristics with other elements, and for a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
 - a. Where variations in color, pattern, texture or other characteristics are inherent in the material or product represented by a Sample, submit sets of multiple units of the Sample (not less than 3 units), which show approximate limits of the variations.
 - b. Refer to other Specification Sections for requirements for Samples that illustrate

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- workmanship, fabrication techniques, details of assembly, connections, operation and similar construction characteristics.
- c. Refer to other Specification Sections for Samples to be returned to the Contractor for incorporation in the Work. Such Samples must be in an undamaged condition at time of use. On the transmittal form, indicate such special requests regarding disposition of Sample submittals.
3. Preliminary Submittals: Where Samples are specified for selection of color, pattern, texture or similar characteristics from a manufacturer's range of standard choices, submit a single, full set of available choices for the material or product.
 - a. Preliminary submittals will be reviewed and returned with the Architect's marking indicating selection and other action taken.
 4. Submittals: Except for Samples intended to illustrate assembly details, workmanship, fabrication techniques, connections, operation and other characteristics, submit 3 sets of Samples; one set will be returned marked with the action taken.
 - a. Maintain sets of Samples, as returned by the Architect, at the Project site, available for quality control comparisons throughout the course of construction activity.
 - b. Unless the Architect observes noncompliance with provisions of the Contract Documents, the submittal may serve as the final submittal.
 - c. Sample sets may be used to obtain final acceptance of the construction associated with each set.
 5. Distribution of Samples: Prepare and distribute additional sets of Samples to subcontractors, suppliers, fabricators, manufacturers, installers, governing authorities, and others as required for performance of the Work. Show distribution on transmittal forms.
 6. Field Samples specified in individual Specification Sections are special types of Samples. Comply with Sample submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

1.5 ARCHITECT'S ACTION

- A. Except for submittals for the record, for information and similar purposes, where action and return on submittals is required or requested, the Architect will review each submittal, mark to indicate the action taken, and return promptly.
 1. Compliance with specified characteristics is the Contractor's responsibility, and not considered part of the Architect's review and indication of action taken.
- B. Action Stamp: The Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:
 1. Final Unrestricted Release: Where submittals are marked "Approved," that part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
 2. Final-But-Restricted Release: When submittals are marked "Approved as Noted," that part of the Work covered by the submittal may proceed provided it complies with both the Architect's notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.
 3. Returned for Resubmittal: When submittal is marked "Not Approved, Revise and

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

Resubmit," do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the Architect's notations; resubmit without delay. Repeat if necessary to obtain a different action mark.

- a. Do not permit submittals marked "Not Approved, Revise and Resubmit" to be used at the Project site, or elsewhere where construction is in progress.
4. Other Action: Where a submittal is primarily for information or record purposes, for special processing or other Contractor activity, the submittal will be returned, marked "Action Not Required".

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION (Not Applicable).

END OF SECTION 01 33 23

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Quality Control Requirements.
2. Administrative and procedural requirements for quality assurance and quality control.

B. Related Sections:

1. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section. Divisions 02 through 50 Sections: Specific test and inspection requirements.

1.02 QUALITY CONTROL REQUIREMENTS

A. General: The Contractor shall establish a system of inspections and tests of his work and that of his subcontractors to ensure that all applicable requirements of the specifications are met.

1. The Contractor shall be diligent to ensure that the quality of workmanship is satisfactory, that dimensional requirements are met, that defective materials are not used and that all required control and laboratory testing procedures are effected.
2. Where specific testing procedures are not stipulated, the Contractor shall establish and conduct a test procedure to ensure adherence to specified quality.
3. The Contractor shall make an initial inspection of each phase of work as soon as a representative portion has been completed, and the Contractor shall make daily follow-up inspections, to ensure that an acceptable quality of work is established and maintained.
4. The Contractor shall perform a pre-final inspection and work off all punch list items prior to Architect's or Owner's inspection(s).

1.03 DEFINITIONS

- A. Conventional Inspections: Inspections, not specifically required by Code, which are considered essential to the proper performance of the building systems.
- B. Inspections: Evaluation of systems, primarily requiring observation and engineering judgment.
- C. Quality-Control Services: Conventional inspections, special inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. Services do not include contract enforcement activities performed by Architect.
- D. Special Inspections: Inspections, required by Code, which monitor the quality of materials and workmanship critical to the structural integrity of the building.
- E. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- F. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.
- G. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- H. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- I. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction and the Owner, to establish product performance and compliance with industry standards.
- J. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- K. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- L. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- M. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
- N. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.04 QUALITY ASSURANCE AND CONTROL SERVICES REQUIREMENTS

- A. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
- B. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, the Contract Documents, or authorities having jurisdiction are not limited by provisions of this Section.

1.05 CONFLICTING REQUIREMENTS

- A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement, unless directed otherwise by the Owner. Refer uncertainties and requirements that are different, but apparently equal, to the Architect, in writing, for the Owner's decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect, in writing, for the Owner's decision before proceeding.

1.06 SUBMITTALS

- A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. Reports: Prepare and submit certified written reports that include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals performing making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on retesting and re-inspecting.
- C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.07 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.
- F. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- G. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

H. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

1.08 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Payment for these services will be made from allowances, as authorized by the Owner.
3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Modification.

B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction, at no additional expense to the Owner or Architect. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

1. Where services are not indicated as Owner's responsibility, engage a qualified testing agency to perform these quality-control services.
2. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
3. Notify testing agencies and Architect at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
4. For all quality-control services that are not indicated as Owner's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 - Submittal Procedures.

D. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect, Owner, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform any duties of Contractor.
- F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.09 STANDARD AND INDUSTRY SPECIFICATIONS

- A. Any material or operation specified by reference to the published specification of a manufacturer, The American Society for Testing and Materials (ASTM), The American Standards Association (ASA), Federal Specifications, or other published standard shall comply with the requirements of the current specification or standard listed. Should there be a discrepancy between the referenced specification and the contract documents the latter shall govern unless written interpretation is obtained from the Owner. Should there be discrepancies among referenced specifications or standards, the more stringent requirements shall govern.
- B. The Contractor shall, if requested, furnish an affidavit from the manufacturer(s) certifying that the materials or products being furnished meet the requirements specified. Such certification, however, shall not relieve the Contractor from the responsibility of complying with other requirements of the contract documents.

1.10 MANUFACTURER'S DIRECTIONS

- A. All manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturers unless herein specified to the contrary. Should there be a discrepancy between an installation as required by the drawings and/or specifications and the manufacturer's directions and/or recommendations, such discrepancy shall be brought to the attention of the Architect and shall be resolved before the work may proceed.

1.11 APPROVED MATERIAL REQUIREMENTS

- A. In the event the architectural, plumbing, mechanical and/or electrical requirements of any "APPROVED" material is different from that specified and/or as indicated on the drawings, any additional cost involved shall be the responsibility of the Contractor. No extra cost to the Owner or Architect will be allowed because of the use of such materials.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1.12 USE OF FOREIGN MATERIALS

- A. The Contractor shall agree to use in the execution of this contract only materials, supplies, and products manufactured, mined, processed, or otherwise produced in accordance with the Buy American Act (41 USC 10a-10d).

1.13 EXAMINATION OF SURFACES AND/OR CONDITIONS

- A. The Contractor shall examine all surfaces on which, or against which, their work is to be applied and shall notify the Architect in writing of any defects the Contractor may discover which, in the Contractor's opinion, would be detrimental to the proper installation or operation of the Contractor's products. Commencing of work by the Contractor denotes acceptance by Contractor of all surfaces and conditions affecting Contractor's work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Comply with the Contract Document requirements for Section 01 73 29 - Cutting and Patching.
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 1 – GENERAL REQUIREMENTS
Section 01 45 00 – Quality Control Systems

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for quality control services.
- B. Quality control services include inspections and tests and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the Architect.
- C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.
- D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.
 - 1. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Those requirements, including inspections and tests, cover production of standard products as well as customized fabrication and installation procedures.
 - 2. Inspections, test and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.
 - 3. Requirements for the Contractor to provide quality control services required by the Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 RESPONSIBILITIES

- A. Contractor Responsibilities: The Contractor shall provide inspections, tests and similar quality control services, specified in individual Specification Sections and required by governing authorities, except where they are specifically indicated to be the Owner's responsibility, or are provided by another identified entity; these services include those specified to be performed by an independent agency and not by the Contractor. Costs for these services shall be included in the Contract Sum.
 - 1. The Contractor shall employ and pay an independent agency, to perform specified quality control services.
 - 2. The Owner will engage and pay for the services of an independent agency to perform inspections and tests specified as the Owner's responsibility.
 - 3. The Owner will engage the services of an independent agency to perform inspections and tests specified as the Owner's responsibilities. Payment for these services will be made from the Project Contingency and Testing and Engineering services line item established by the Owner.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Where the Owner has engaged a testing agency or other entity for testing and inspection of a part of the Work, and the Contractor is also required to engage an entity for the same or related element, the Contractor shall not employ the entity engaged by the Owner, unless otherwise agreed in writing with the Owner.
4. Retesting: The Contractor is responsible for retesting where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.
 - a. Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on original construction.
5. Associated Services: The Contractor shall cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to:
 - a. Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.
 - b. Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.
 - c. Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.
 - d. Providing the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
 - e. Security and protection of samples and test equipment at the Project site.
- B. Owner Responsibilities: The Owner will provide inspections, tests and similar quality control services specified to be performed by independent agencies and not by the Contractor, except where they are specifically indicated as the Contractor's responsibility or are provided by another identified entity. Costs for these services are not included in the Contract Sum.
 1. The Owner will employ and pay for the services of an independent agency, testing laboratory or other qualified firm to perform services which are the Owner's responsibility.
- C. Duties of the Testing Agency: The independent testing agency engaged to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections shall cooperate with the Architect and Contractor in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.
 1. The agency shall notify the Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. The agency is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.
 3. The agency shall not perform any duties of the Contractor.
- D. Coordination: The Contractor and each agency engaged to perform inspections, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition the Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. The Contractor is responsible for scheduling times for inspections, tests, taking samples and similar activities.

1.4 SUBMITTALS

- A. The independent testing agency shall submit a certified written report of each inspection, test or similar service, to the Architect, in duplicate, unless the Contractor is responsible for the service. If the Contractor is responsible for the service, submit a certified written report of each inspection, test or similar service through the Contractor, in duplicate.
 1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
 2. Report Data: Written reports of each inspection, test or similar service shall include, but not be limited to:
 - a. Date of issue.
 - b. Project title and number.
 - c. Name, address and telephone number of testing agency.
 - d. Dates and locations of samples and tests or inspections.
 - e. Names of individuals making the inspection or test.
 - f. Designation of the Work and test method.
 - g. Identification of product and Specification Section.
 - h. Complete inspection or test data.
 - i. Test results and an interpretations of test results.
 - j. Ambient conditions at the time of sample-taking and testing.
 - k. Comments or professional opinion as to whether inspected or tested Work complies with Contract Document requirements.
 - l. Name and signature of laboratory inspector.
 - m. Recommendations on retesting.

1.5 QUALITY ASSURANCE

- A. Qualification for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.
 1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the State in which the Project is located.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

- A. General: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for "Cutting and Patching."
- B. Protect construction exposed by or for quality control service activities, and protect repaired

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

construction.

- C. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION 01 45 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 1: GENERAL REQUIREMENTS
Section 01 50 00: Temporary Facilities

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies requirements for temporary services and facilities, including utilities, construction and support facilities, security and protection.
- B. Temporary utilities required include but are not limited to:
 - 1. Water service and distribution.
 - 2. Temporary electric power and light.
 - 3. Telephone service.
 - 4. Storm and sanitary sewer.
- C. Temporary construction and support facilities required include but are not limited to:
 - 1. Temporary heat.
 - 2. Field offices and storage sheds.
 - 3. Temporary roads and paving.
 - 4. Sanitary facilities, including drinking water.
 - 5. Dewatering facilities and drains.
 - 6. Temporary enclosures.
 - 7. Hoists and temporary elevator use.
 - 8. Temporary Project identification signs and bulletin boards.
 - 9. Waste disposal services.
 - 10. Rodent and pest control.
 - 11. Construction aids and miscellaneous services and facilities.
- D. Security and protection facilities required include but are not limited to:
 - 1. Temporary fire protection.
 - 2. Barricades, warning signs, lights.
 - 3. Sidewalk bridge or enclosure fence for the site.
 - 4. Environmental protection.

1.3 SUBMITTALS

- A. Temporary Utilities: Submit reports of tests, inspections, meter readings and similar procedures performed on temporary utilities.
- B. Implementation and Termination Schedule: Submit a schedule indicating implementation and termination of each temporary utility within 15 days of the date established for commencement of the Work.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1.4 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations if authorities having jurisdiction, including but not limited to:
 - 1. Building Code requirements.
 - 2. Health and safety regulations.
 - 3. Utility company regulations.
 - 4. Police, Fire Department and Rescue Squad rules.
 - 5. Environmental protection regulations.

- B. Standards: Comply with NFPA Code 241, "Building Construction and Demolition Operations", ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition", and NECA Electrical Design Library "Temporary Electrical Facilities."
 - 1. Refer to "Guidelines for Bid Conditions for Temporary Job Utilities and Services", prepared jointly by AGC and ASC, for industry recommendations.
 - 2. Electrical Service: Comply with NEMA, NECA and UL standards and regulations for temporary electric service. Install service in compliance with National Electric Code (NFPA 70).

- C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.5 PROJECT CONDITIONS

- A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of the permanent service.

- B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide new materials; if acceptable to the Architect, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.

- B. Lumber and Plywood: Comply with requirements in Division-6 Section "Rough Carpentry."
 - 1. For job-built temporary offices, shops and sheds within the construction area, provide UL labeled, fire treated lumber and plywood for framing, sheathing and siding or comply with local codes.
 - 2. For signs and directory boards, provide exterior type, Grade B-B High Density Concrete Form Overlay Plywood conforming to PS-1, of sizes and thickness indicated.
 - 3. For fences and vision barriers, provide exterior type, minimum 3/8" thick plywood.
 - 4. For safety barriers, sidewalk bridges and similar uses, provide minimum 5/8" thick exterior plywood.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- C. Gypsum Wallboard: Provide gypsum wallboard complying with requirements of ASTM C 36 on interior walls of temporary offices.
- D. Roofing Materials: Provide UL Class "A" standard weight asphalt shingles complying with ASTM D 3018, or UL Class "C" mineral surfaced roll roofing complying with ASTM D 249 on roofs of job-built temporary offices, shops and sheds.
- E. Paint: Comply with requirements of Division-9 Section "Finish Painting."
 - 1. For job-built temporary offices, shops, sheds, fences and other exposed lumber and plywood, provide exterior grade acrylic-latex emulsion over exterior primer.
 - 2. For sign panels and applying graphics, provide exterior grade alkyd gloss enamel over exterior primer.
 - 3. For interior walls of temporary offices, provide two coats interior latex flat wall paint.
- F. Tarpaulins: Provide waterproof, fire-resistant, UL labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures provide translucent nylon reinforced laminated polyethylene or polyvinyl chloride fire retardant tarpaulins.
- G. Water: Provide potable water approved by local health authorities.
- H. Open-Mesh Fencing: Provide 11-gage, galvanized 2-inch, chain link fabric fencing 6-feet high with galvanized barbed wire top strand and galvanized steel pipe posts, 1-1/2" I.D. for line posts and 2-1/2" I.D. for corner posts.

2.2 EQUIPMENT

- A. General: Provide new equipment; if acceptable to the Architect, undamaged, previously used equipment in serviceable condition may be used. Provide equipment suitable for use intended.
- B. Water Hoses: Provide 3/4" heavy-duty, abrasion-resistant, flexible rubber hoses 100 ft. long, with pressure rating greater than the maximum pressure of the water distribution system; provide adjustable shut-off nozzles at hose discharge.
- C. Electrical Outlets: Provide properly configured NEMA polarized outlets to prevent insertion of 110-120 volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for connection of power tools and equipment.
- D. Electrical Power Cords: Provide grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas where construction activities are in progress.
- E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered glass enclosures, where exposed to breakage. Provide exterior fixtures where exposed to moisture.
- F. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM or another recognized trade association related to the type of fuel being consumed.
- G. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockable entrances, operable windows and serviceable finishes. Provide heated and air-conditioned units on foundations adequate for normal loading.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- H. Temporary Toilet Units: Provide self-contained single-occupant toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material.
- I. First Aid Supplies: Comply with governing regulations.
- J. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable, UL-rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures.
 - 1. Comply with NFPA 10 and 241 for classification, extinguishing agent and size required by location and class of fire exposure.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed, or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.
 - 1. Arrange with the company and existing users for a time when service can be interrupted, where necessary, to make connections for temporary services.
 - 2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
 - 3. Obtain easements to bring temporary utilities to the site, where the Owner's easements cannot be used for that purpose.
 - 4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Architect, and will not be accepted as a basis of claims for a Change Order.
- B. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.
 - 1. Sterilization: Sterilize temporary water piping prior to use.
- C. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload protected disconnects, automatic ground-fault interrupters and main distribution switch gear.
 - 1. Except where overhead service must be used, install electric power service underground.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Power Distribution System: Install wiring overhead, and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, AC 20 ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.
- D. Temporary Lighting: Whenever overhead floor or roof deck has been installed, provide temporary lighting with local switching.
 1. Install and operate temporary lighting that will fulfill security and protection requirements, without operating the entire system, and will provide adequate illumination for construction operations and traffic conditions.
- E. Temporary Telephones: Provide temporary telephone service for all personnel engaged in construction activities, throughout the construction period. Install telephone on a separate line for each temporary office and first aid station. Where an office has more than two occupants, install a telephone for each additional occupant or pair of occupants.
 1. At each telephone, post a list of important telephone numbers.
- F. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off the site in a lawful manner.
 1. Filter out excessive amounts of soil, construction debris, chemicals, oils and similar contaminants that might clog sewers or pollute waterways before discharge.
 2. Connect temporary sewers to the municipal system as directed by the sewer department officials.
 3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. Following heavy use, restore normal conditions promptly.
- G. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

3.3 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

- A. Locate field offices, storage sheds, sanitary facilities and other temporary construction and support facilities for easy access.
 1. Maintain temporary construction and support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
- B. Provide incombustible construction for offices, shops and sheds located within the construction area, or within 30 feet of building lines. Comply with requirements of NFPA 241.
- C. Temporary Heat: Provide temporary heat required by construction activities, for curing or drying of completed installations or protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- D. Heating Facilities: Except where use of the permanent system is authorized, provide vented self-contained LP gas or fuel oil heaters with individual space thermostatic control or other systems complying with OSHA Regulations.
1. Use of gasoline-burning space heaters, open flame, or salamander type heating units is prohibited.
- E. Field Offices: Provide insulated, weathertight temporary offices of sufficient size to accommodate required office personnel at the Project site. Keep the office clean and orderly for use for small progress meetings. Furnish and equip offices as follows:
1. Furnish with a desk and chairs, a 4-drawer file cabinet, plan table and plan rack and a 6-shelf bookcase.
 2. Equip with a water cooler and private toilet complete with water closet, lavatory and mirror-medicine cabinet unit.
- F. Storage and Fabrication Sheds: Install storage and fabrication sheds, sized, furnished and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds may be open shelters or fully enclosed spaces within the building or elsewhere on the site.
- G. Temporary Paving: Construct and maintain temporary roads and paving to adequately support the indicated loading and to withstand exposure to traffic during the construction period. Locate temporary paving for roads, storage areas and parking where the same permanent facilities will be located. Review proposed modifications to permanent paving with the Architect.
1. Paving: Comply with Division-2 Section "Asphalt Concrete Paving" or local Building Officials requirements for construction and maintenance of temporary paving.
 2. Coordinate temporary paving development with subgrade grading, compaction, installation and stabilization of subbase, and installation of base and finish courses of permanent paving.
 3. Install temporary paving to minimize the need to rework the installations and to result in permanent roads and paved areas that are without damage or deterioration when occupied by the Owner.
 4. Delay installation of the final course of permanent asphalt concrete paving until immediately before Substantial Completion. Coordinate with weather conditions to avoid unsatisfactory results.
 5. Extend temporary paving in and around the construction area as necessary to accommodate delivery and storage of materials, equipment usage, administration and supervision.
- H. Sanitary facilities include temporary toilets, wash facilities and drinking water fixtures. Comply with regulations and health codes for the type, number, location, operation and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.
1. Provide toilet tissue, paper towels, paper cups and similar disposable materials for each facility. Provide covered waste containers for used material.
- I. Toilets: Use of the Owner's existing toilet facilities will be permitted, so long as facilities are cleaned and maintained in a condition acceptable to the Owner. At Substantial Completion, restore these facilities to the condition prevalent at the time of initial use.
- J. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Use of pit-type privies

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

will not be permitted.

- K. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a healthy and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.
 - 1. Provide safety showers, eye-wash fountains and similar facilities for convenience, safety and sanitation of personnel.
- L. Drinking Water Fixtures: Provide drinking water fountains where indicated, including paper supply.
- M. Drinking Water Facilities: Provide containerized tap-dispenser bottled-water type drinking water units, including paper supply.
 - 1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F (7 to 13 deg C).
- N. Dewatering Facilities and Drains: For temporary drainage and dewatering facilities and operations not directly associated with construction activities included under individual Sections, comply with dewatering requirements of applicable Division-2 Sections. Where feasible, utilize the same facilities. Maintain the site, excavations and construction free of water.
- O. Temporary Enclosures: Provide temporary enclosure for protection of construction in progress and completed, from exposure, foul weather, other construction operations and similar activities.
 - 1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
 - 2. Install tarpaulins securely, with incombustible wood framing and other materials. Close openings of 25 square feet or less with plywood or similar materials.
 - 3. Close openings through floor or roof decks and horizontal surfaces with load-bearing wood-framed construction.
 - 4. Where temporary wood or plywood enclosure exceeds 100 square feet in area, use UL-labeled fire-retardant treated material for framing and main sheathing.
- P. Temporary Lifts and Hoists: Provide facilities for hoisting materials and employees. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- Q. Temporary Elevator Use: Refer to Division-14 "Elevator" Sections.
- R. Project Identification and Temporary Signs: Prepare project identification and other signs of the size indicated; install signs where indicated to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative treated wood or steel. Do not permit installation of unauthorized signs.
 - 1. Project Identification Signs: Engage an experienced sign painter to apply graphics. Comply with details indicated.
 - 2. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- S. Temporary Exterior Lighting: Install exterior yard and sign lights so that signs are visible when Work is being performed.
- T. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F (27 deg C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material in a lawful manner.
- U. Rodent and Pest Control: Before deep foundation Work has been completed, retain a local exterminator or pest control company to recommend practices to minimize attraction and harboring of rodents, roaches and other pests. Employ this service to perform extermination and control procedures at regular intervals so the Project will be relatively free of pests and their residues at Substantial Completion. Perform control operations in a lawful manner using environmentally safe materials.
- V. Stairs: Until permanent stairs are available, provide temporary stairs, ladders and guard rails complying with OSHA Regulations. Cover finished permanent stairs with a protective covering of plywood or similar material so finishes will be undamaged at the time of acceptance.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer as requested by the Architect.
- B. Temporary Fire Protection: Until fire protection needs are supplied by permanent facilities, install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers," and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations."
 - 1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
 - 2. Store combustible materials in containers in fire-safe locations.
 - 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.
 - 4. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition.
- C. Permanent Fire Protection: At the earliest feasible date in each area of the Project, complete installation of the permanent fire protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
- D. Barricades, Warning Signs and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed provide lighting, including flashing red or amber lights.
- E. Enclosure Fence: When excavation begins, install an enclosure fence with lockable entrance gates. Locate where indicated, or enclose the entire site or the portion determined sufficient to

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

accommodate construction operations. Install in a manner that will prevent people, dogs and other animals from easily entering the site, except by the entrance gates.

1. Provide open-mesh, chain-link fencing with posts set in a compacted mixture of gravel and earth.
 2. Provide plywood fence, 8-feet high, framed with four 2" x 4" rails, and preservative treated wood posts spaced not more than 8-feet apart.
- F. Covered Walkway: Erect a structurally adequate protective covered walkway for passage of persons along the adjacent public street. Coordinate with entrance gates, other facilities and obstructions. Comply with regulations of authorities having jurisdiction.
1. Construct using scaffold or shoring framing, waterproofed wood plank overhead decking, protective plywood enclosure walls, handrails, barricades, warning signs, lights, safe and well- drained walkways and similar provisions for protection and safe passage. Extend the backwall beyond the structure to complete the enclosure fence. Paint and maintain in a manner acceptable to the Owner and Architect.
- G. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft and similar violations of security.
1. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.
- H. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site or restricted by local Building Official, if any.

3.5 OPERATION, TERMINATION AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation and similar facilities on a 24-hour day basis where required to achieve indicated results and to avoid possibility of damage.
 2. Protection: Prevent water filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, or when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Materials and facilities that constitute temporary facilities are property of the Contractor. The Owner reserves the right to take possession of Project identification signs.
2. Remove temporary paving that is not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that does not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances which might impair growth of plant materials or lawns. Repair or replace street paving, curbs and sidewalks at the temporary entrances, as required by the governing authority.
3. At Substantial Completion, clean and renovate permanent facilities that have been used during the construction period, including but not limited to:
 - a. Replace air filters and clean inside of ductwork and housings.
 - b. Replace significantly worn parts and parts that have been subject to unusual operating conditions.
 - c. Replace lamps that are burned out or noticeably dimmed by substantial hours of use.

END OF SECTION 01 50 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

SECTION 01 56 00
TEMPORARY FLOORING PROTECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Temporary jobsite protection including:
 - 1. Floor protection sheathing.
 - 2. Floor Protection seaming tape.
 - 3. Adhesive tape.

1.2 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation and removal methods.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 5 years documented experience manufacturing similar products.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store indoors in accordance with the manufacturer's recommendation.
- B. Store products in manufacturer's unopened packaging until ready for installation.
- C. Remove and dispose of materials in accordance with requirements of local authorities having jurisdiction.

1.5 SEQUENCING

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress and to protect all flooring in place.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Ram Board/Surface Shields, which is located at: 8450 W. 185th St.; Tinley Park, IL 60487; Tel: 855-848-8678; Fax: 818-848-0099; Email:[request info \(kmeister@ramboard.com\)](mailto:request_info@kmeister@ramboard.com); Web:<http://www.ramboard.com>|<http://www.surface Shields.com>
- B. Substitutions: Not permitted.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 FLOOR AND WALL PROTECTION

- A. Ram Board Plus: Model No. RB PLUS 38-100 Ram Board Plus as manufactured by Ram Board. Board is pre-taped for faster installs.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Standards Compliance: FSC certified. Recycled and recyclable materials.
 2. Pre-Taped for Faster Installs saving up to 30 percent on installation of surface protection.
 3. Wall Guard Feature: Fold lines allowing corner, horizontal and vertical wall protection.
 - a. Wall guard fold lines at 4, 8, and 12 inch (101, 203, and 305 mm) from edge of board.
 4. Flex-Fiber Technology: Unmatched protection from impact while remaining flexible.
 5. Vapor-Cure Technology: Allows protected substrates and finishes to cure while being protected so work may continue.
 6. Spill Guard Technology: Added protection against water, paint, mud, and more.
 7. Roll Dimensions (W x L): 38 inch x 100 ft (965 mm x 30.5 m). 317 sq ft (29.5 sq m).
 8. Rolls per Pallet: 16.
- B. Ram Board: Model No. RB 38-100 Ram Board as manufactured by Ram Board. Heavy-duty temporary and reusable floor and wall protection.
1. Standards Compliance: FSC certified. Recycled and recyclable materials.
 2. Wall Guard Feature: Fold lines allowing corner, horizontal and vertical wall protection.
 - a. Wall guard fold lines at 4, 8, and 12 inch (101, 203, and 305 mm) from edge of board.
 3. Flex-Fiber Technology: Unmatched protection from impact while remaining flexible.
 4. Vapor-Cure Technology: Allows protected substrates and finishes to cure while being protected so work may continue.
 5. Spill Guard Technology: Added protection against water, paint, mud, and more.
 6. Roll Dimensions (W x L): 38 inch x 100 ft (965 mm x 30.5 m). 317 sq ft (29.5 sq m).
 7. Rolls per Pallet: 16.
 8. Spill Guard Technology: Added protection against water, paint, mud, and more.
 9. Roll Dimensions (W x L): 48 inch x 100 ft (1219 mm x 30.5 m). 400 sq ft (37.1 sq m).
 10. Rolls per Pallet: 16.
- C. Ram Board: Model No. RB 48-100 Ram Board as manufactured by Ram Board. Heavy-duty temporary and reusable floor and wall protection.
1. Standards Compliance: FSC certified. Recycled and recyclable materials.
 2. Wall Guard Feature: Fold lines allowing corner, horizontal and vertical wall protection.
 - a. Wall guard fold lines at 4 inch (101 mm), 8 inch (203 mm) and 12 inch (305 mm) from edge of board.
 3. Flex-Fiber Technology: Provides unmatched protection from impact while remaining flexible.
 4. Vapor-Cure Technology: Allows protected substrates and finishes to cure while being protected so work may continue. Ram Board Plus tape isn't breathable.
 5. Spill Guard Technology: Provides added protection against water, paint, mud, and more.
 6. Material Thickness: 46 mils (1.17 mm).
 7. Roll Dimensions (W x L): 48 in x 100 ft (1219 mm x 30.5 m). 400 sq ft (37.1 sq m).
 8. Rolls per Pallet: 16.
- D. Ram Board Home Edition: Model No. RBHE 36-50 Ram Board Home Edition as manufactured by Ram Board. Re-usable protection for small projects.
1. Standards Compliance: FSC certified. Recycled and recyclable materials.
 2. Wall Guard Feature: Fold lines allowing corner, horizontal and vertical wall protection.
 3. Flex-Fiber Technology: Unmatched protection from impact while remaining flexible.
 4. Vapor-Cure Technology: Allows protected substrates and finishes to cure while being protected so work may continue.
 5. Spill Guard Technology: Added protection against water, paint, mud, and more.
 6. Material Thickness: 36 mils (0.91 mm), 15 percent thinner than Ram Board.
 7. Roll Dimensions (W x L): 36 in x 50 ft (914 mm x 15.24 m). 150 sq ft (13.9 sq m).

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

8. Rolls per Box: 9.
- E. Ram Board Painter's Board: Model No. 20RB 35-50 Ram Board Painter's Board as manufactured by Ram Board. Floor protection for painting projects.
1. Standards Compliance: FSC certified. Recycled and recyclable materials.
 2. Flex-Fiber Technology: Unmatched protection from impact while remaining flexible.
 3. Vapor-Cure Technology: Allows protected substrates and finishes to cure while being protected so work may continue.
 4. Spill Guard Technology: Added protection against water, paint, mud, and more.
 5. Stronger than red rosin papers.
 6. Roll Dimensions (W x L): 35 inch x 50 ft (889 mm x 15.24 m). 145.83 sq ft (13.54 sq m).
- F. Kraft Shield: Model No. KP35144 as manufactured by Surface Shields.
1. Features:
 - a. Protects floors, cabinets and counter tops from foot traffic, paint and spills.
 - b. Preferred alternative to "Red Rosin" paper.
 - c. Non-staining.
 2. Applications:
 - a. Construction.
 - b. Remodeling.
 - c. Industrial.
 - d. Drywall.
 - e. Painting.
 - f. Temporary protection.
 3. Product Specifications:
 - a. Thickness: n.a.
 - b. Material: Paper.
 - c. Tensile Strength: n.a.
 - d. Temperature (Ideal): 70 degrees F (21 degrees C).
 - e. Humidity (Ideal): 50 percent.
 - f. Elongation: n.a.
 - g. Chemical Name: Paper.
 - h. Chemical Formula: Proprietary.
 - i. Trade Name: Kraft shield.
 - j. Material Use: Surface protection.
 - k. Environmental: Bio-degradable.
 4. Available Size (W x L): KP35144; Natural, 35 inch (889 mm) x 144 ft (43.9 m), 10 lbs (4.53 kg).
 5. Instructions: Before laying Kraft Shield, thoroughly sweep area to remove dust and debris. Place on desired surface and unroll. Cut to length with utility knife. Seam multiple pieces together with tape for larger areas. Do not adhere tape directly to floors. When finished, roll up Kraft Shield and discard. If Kraft Paper becomes damaged or wet replace with new Kraft Shield.
 6. Handling and Storage: Store at room temperature. Avoid high humid environments.
- G. Multi Shield: Model No. MS40164 as manufactured by Surface Shields.
1. Features:
 - a. Self-adhering mat for multi surfaces.
 - b. Will not leave a sticky residue.
 - c. Shields work area from dirt, moisture and liquids.
 - d. Light-weight and breathable.
 - e. Reusable and easily rolls up for quick storage.
 - f. Durable, tear-proof and hard-wearing.
 2. Applications:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Construction.
 - b. Remodeling.
 - c. Industrial.
 - d. Drywall.
 - e. Painting.
 - f. Temporary protection.
3. Product Specifications
 - a. Thickness: 0.098 to 0.110 inches (2.5 - 2.8 mm).
 - b. Material: PET Fibers (100 percent recycled fibers) with PE waterproof top layer.
 - c. Underside: Residue free, anti-slip adhesion.
 - d. Adhesion Level: 6 oz per inch (0.17 kg per 25 mm).
 - e. Tensile Strength: 115 to 120 psi (793 to 827 kPa).
 - f. Temperature (Ideal): 70 degrees F (21 degrees C).
 - g. Humidity (Ideal): 50 percent.
 - h. Elongation: 80 to 90 percent.
 - i. Chemical Name: n.a.
 - j. Chemical Family: n.a.
 - k. Chemical Formula: Proprietary.
 - l. Trade Name: Multi shield.
 - m. Material Use: Surface protection.
 4. Available Sizes:
 - a. MS4054: Blue, 40 inch (1016 mm) x 54 ft (16.46 m), 6 lbs (2.72 kg).
 - b. MS40164: Blue, 40 inch (1016 mm) x 164 ft (49.98 m), 18 lbs (8.16 kg).
 5. Handling and Storage: No special handling requirements.
 - a. Keep away from flammable and combustible material. Paper products will not release hazardous chemicals under normal conditions of use.
 6. Installation Instructions: Before laying Multi Shield, thoroughly sweep area to remove dust and debris. Place on desired surface and unroll. Cut to length with utility knife. Seam multiple pieces together with tape for larger areas. Do not adhere tape directly to floors. When finished, roll up Multi Shield for reuse or disposal.
- H. Cover Shield Flame Retardant Protection: Model No. CVR2036100 as manufactured by Surface Shields.
1. Features:
 - a. Premium and standard quality.
 - b. Protects: Hotels, hospitals, power plants, commercial floors, ships, yachts.
 - c. Easy to install and remove.
 - d. Cost effective protection for any surface.
 - e. Lays flat, is conformable, tear resistant, durable, and dense.
 - f. Embossed fire rating NFPA701. No need for paperwork certification for inspectors.
- I. Multi Surface Protection Film: Model No. FS36500 as manufactured by Surface Shields
1. Features:
 - a. Self-adhering mat for hard surfaces.
 - b. Shields work area from dirt and moisture.
 - c. Protects tile, marble, granite, vinyl, laminates and factory finished hardwood.
 - d. Can also prevent damage to tubs and counters.
 - e. Reduces clean up time and damage claims.
 2. Applications: Recommended for hard surfaces like VCT, laminate, and factory finished hardwood floors. Not recommended for hardwood floors that are not factory finished.
 - a. Construction.
 - b. Moving.
 - c. Remodeling.
 - d. Model homes.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- e. Drywall.
 - f. Painting.
 - g. Parties.
 - h. Temporary protection.
3. Product Specifications:
- a. Thickness 3.0 mil (0.076 mm) nominal.
 - b. Film low density polyethylene.
 - c. Adhesive Type: Formulated acrylic.
 - d. Adhesion Level: 5 to 9 oz per inch (0.14 to 0.26 kg).
 - e. Tensile Strength: 3800 psi (26,200 kPa).
 - f. Temperature (Ideal): 70 degrees F (21 degrees C).
 - g. Humidity (Ideal): 50 percent.
 - h. Elongation: 470 percent.
 - i. Chemical Name: Acrylic PSA Tapes.
 - j. Chemical Family: Acrylic PSA Polyethylene Film.
 - k. Chemical Formula: Proprietary.
 - l. Trade Name: Multi Surface.
 - m. Material Use: Surface Protection.
4. Available Sizes:
- a. MU2450W: Green, 24 inch (610 mm) x 50 ft (15.24 m), 1 lb (0.45 kg).
 - b. FS24200L: Green, 24 inch (610 mm) x 200 ft (60.96 m), 7 lbs (3.15 kg).
 - c. FS24500: Green, 24 inch (610 mm) x 500 ft (152.4 m), 17 lbs (7.71 kg).
 - d. FS36250: Green, 36 inch (914 mm) x 250 ft (76.2 m), 13 lbs (5.90 kg).
 - e. FS36500: Green, 36 inch (914 mm) x 500 ft (152.4 m), 26 lbs (11.79 kg).
5. Handling and Storage: Store at room temperature and keep out of direct sunlight exposure. If Multi Surface is stored in extreme conditions, over 95 degrees F (35 degrees C) or below 40 degrees F (4.4 degrees C), allow product to return to room temperature prior to use.
6. Installation Instructions: Before laying Multi Surface protection film, thoroughly sweep/mop area to remove dust and debris. Place on desired surface and unroll. Cut to length with utility knife. When finished, roll up Multi Surface Protection Film for disposal. Replace Multi Surface Protection Film every 30 days or as needed. Do Not apply on hardwood flooring that is not factory finished.
- J. Neo Shield: Model No. NSR27180 as manufactured by Surface Shields
1. Features:
- a. Protects hardwood, ceramic tile, linoleum and carpet.
 - b. Slip-resistant and clings to steps - great for movers.
 - c. Rolls are easy to install and carry from site to site.
 - d. Cut to fit any space and works well on either side.
2. Applications:
- a. Construction.
 - b. Remodeling.
 - c. Moving.
 - d. Drywall.
 - e. Painting.
 - f. Temporary protection.
3. Product Specifications:
- a. Size: 27 inch (686 mm) x 20 ft (6.1 m).
 - b. Color: Blue / Red.
 - c. Thickness: 0.059 inch (1.5 mm).
 - d. Front: Fabric Woven Polyester.
 - e. Backing: Natural Rubber.
 - f. Tensile Strength: n.a.
 - g. Temperature (Ideal): 70 degrees F (21 degrees C).

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- h. Humidity (Ideal): 50 percent.
 - i. Elongation: 200 to 300 percent.
 - j. Chemical Name: n.a.
 - k. Chemical Family: n.a.
 - l. Chemical Formula: Proprietary.
 - m. Trade Name: Neo shield.
 - n. Material Use: Surface protection.
4. Available Sizes:
- a. NSB2720: Blue, 27 inch (686 mm) x 20 ft (6.1 m), 12 lbs.
 - b. NSR2720: Red, 27 inch (686 mm) x 20 ft (6.1 m), 12 lbs.
 - c. NSB27180: Blue, 27 inch (686 mm) x 180 ft (54.86 m), 108 lbs.
 - d. NSR27180: Red, 27 inch (686 mm) x 180 ft (54.86 m), 108 lbs.
5. Handling and Storage: Store at room temperature. If Neo Shield is stored in extreme conditions over 95 degrees F (35 degrees C) or below 40 degrees F (4.4 degrees C) allow product to return to room temperature prior to use.
6. Installation Instructions: Before laying Neo Shield, thoroughly sweep area to remove dust and debris. Place on desired surface and unroll. Cut to length with utility knife.
- K. Plasti Shield: Model No. PLS4896W4 as manufactured by Surface Shields
1. Features:
- a. Non-toxic.
 - b. Strong and durable Impact resistant.
 - c. Cost effective.
 - d. Easy to convert.
 - e. Recyclable: 100 percent.
 - f. Lightweight.
 - g. Reusable.
 - h. Hygienic.
 - i. Water resistant.
2. Applications:
- a. Construction.
 - b. Remodeling.
 - c. Tuck pointing.
 - d. Drywall.
 - e. Painting.
 - f. Temporary protection.
3. Product Specifications:
- a. Thickness: 0.157 inch (4 mm).
 - b. Material: Polypropylene.
 - c. Density (grams/sq. meter): 650.
 - d. Density (lbs./1000 sq. ft.): 133.
 - e. Surface Tension (Dyne Level): 42 dyne/cm.
 - f. Tear Strength: 1700 gms.
 - g. Tensile Strength: 4000 psi (27,579 kPa)
 - h. Impact Dart Strength: 320 inches per lb (17.92 m per kg).
 - i. Temperature (Ideal): 70 degrees F (21 degrees C).
 - j. Humidity (Ideal): 50 percent.
 - k. Heat Def. Load: 174 degrees at 66 psi (455 kPa).
 - l. Chemical Name: Polypropylene homopolymer.
 - m. Chemical Family: Copolymer polypropylene.
 - n. Chemical Formula: Proprietary.
 - o. Trade Name: Plasti Shield.
 - p. Material Use: Surface protection.
4. Available Sizes:
- a. PLS4896W4: White, 48 x 96 inch (1219 x 2438 mm), 4 lbs (1.81 kg).

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

5. Handling and Storage: No special handling requirements.
 - a. Keep away from flammable and combustible material. Paper products will not release hazardous chemicals under normal conditions of use.
 6. Installation Instructions:
 - a. Flooring Installation: Before laying Plasti Shield, thoroughly sweep area to remove dust and debris. Lay out Plasti Shield to cover the whole area, cut Plasti Shield to length as needed. Seam Plasti Shield together with an appropriate adhesive tape. Replace any Plasti Shield that becomes damaged.
 - b. Wall Installation: Before attaching Plasti Shield, test tape against the wall, to ensure no negative interactions. Provide enough Plasti Shield to cover the whole area, and cut Plasti Shield to length. Seam Plasti Shield together with an appropriate adhesive tape such as Arm Bar Tape by Surface Shields. Replace any Plasti Shield that becomes damaged.
 - c. Door Installation: Before attaching Plasti Shield, test tape against the door, to ensure no negative interactions. Provide enough Plasti Shield to cover the door, and cut Plasti Shield to length. Replace any Plasti Shield that becomes damaged.
- L. Plasti Shield FR: Model No. PLS4896LBFR as manufactured by Surface Shields
1. Features:
 - a. Fire resistant.
 - b. Strong and durable.
 - c. Impact resistant.
 - d. Cost effective.
 - e. Easy to convert.
 - f. 100 percent recyclable.
 - g. Lightweight.
 - h. Reusable.
 - i. Hygienic.
 - j. Water resistant.
 2. Applications:
 - a. Construction.
 - b. Remodeling.
 - c. Tuck Pointing.
 - d. Drywall.
 - e. Painting.
 - f. Temporary protection.
 3. Product Specifications:
 - a. Thickness: 0.157 inch (4 mm).
 - b. Material: Polypropylene.
 - c. Density (grams/sq. meter): 650.
 - d. Density (lbs./1000 sq. ft.): 133.
 - e. Surface Tension (Dyne Level): 42 dyne per cm.
 - f. Tear Strength: 1700 gms
 - g. Tensile Strength: 4000 psi (27,579 kPa).
 - h. Impact Dart Strength: 320 inches per lb (17.92 m per kg).
 - i. Temperature (Ideal): 70 degrees F (21 degrees C).
 - j. Humidity (Ideal): 50 percent.
 - k. Heat Def. Load: 174 degrees at 66 psi (455 kPa).
 - l. Chemical Name: Polypropylene homopolymer.
 - m. Chemical Family: Polypropylene.
 - n. Chemical Formula: Proprietary.
 - o. Trade Name: Plasti Shield fire resistant.
 - p. Material Use: Surface protection.
 4. Available Sizes

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. PLS4896LBFR: Blue, 48 x 96 inch (1219 x 2438 mm), 4 lbs (1.81 kg).
 5. Handling and Storage: No special handling requirements.
 - a. Keep away from flammable and combustible material. Paper products will not release hazardous chemicals under normal conditions of use.
 6. Installation Instructions
 - a. Flooring Installation: Before laying Plasti Shield, thoroughly sweep area to remove dust and debris. Lay out Plasti Shield to cover the whole area, cut Plasti Shield to length as needed. Seam Plasti Shield together with an appropriate adhesive tape. Replace any Plasti Shield that becomes damaged.
 - b. Wall Installation: Before attaching Plasti Shield, test tape against the wall, to ensure no negative interactions. Provide enough Plasti Shield to cover the whole area, and cut Plasti Shield to length. Seam Plasti Shield together with an appropriate adhesive tape such as Arm Bar Tape by Surface Shields. Replace any Plasti Shield that becomes damaged.
 - c. Door Installation: Before attaching Plasti Shield, test tape against the door, to ensure no negative interactions. Provide enough Plasti Shield to cover the door, and cut Plasti Shield to length. Replace any Plasti Shield that becomes damaged.
- M. Plasti Shield Pro:
1. Features:
 - a. Non-toxic.
 - b. 100 percent recyclable.
 - c. Strong and durable.
 - d. Lightweight.
 - e. Impact resistant.
 - f. Reusable.
 - g. Cost effective.
 - h. Hygienic.
 - i. Easy to convert.
 - j. Water resistant.
 2. Applications:
 - a. Construction.
 - b. Drywall.
 - c. Remodeling.
 - d. Painting.
 - e. Tuck Pointing.
 - f. Temporary Protection.
 3. Product Specifications:
 - a. Thickness: 0.16 inches (4 mm).
 - b. Thickness of inside flutes: 0.011 inches (0.3 mm).
 - c. Thickness of outside walls: 0.013 inches (0.35 mm).
 - d. Material: 75 percent polypropylene, 25 percent calcium stuffing.
 - e. Density (grams/sq. meter): 1200 GSM.
 - f. Tensile Strength: MD: 146 lbf (649.4 N). XD: 83 lbf (369.2 N).
 - g. Elongation: MD: 90 percent. XD: 230 percent.
 - h. Low Temperature Flex: Minus 20 degrees F (Minus 29 degrees C).
 - i. Dynamic Puncture: 15 J.
 - j. Avg. Compressive Strength: Flat-Wise: 71.5 psi (493 kPa). Edge-Wise: 925 psi (6378 kPa).
 - k. Temperature (Ideal): 70 degrees F (21 degrees C).
 - l. Humidity (Ideal): 50 percent.
 - m. Chemical Name: Polypropylene Homopolymer or Copolymer.
 - n. Chemical Family: Polypropylene.
 - o. Chemical Formula: Proprietary.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

4. Available Size: PLS449341200: White 44 x 93 inches (1118 x 2362 mm).
 5. Handling and Storage: No special handling requirements. Product will not release hazardous chemicals under normal conditions of use.
 6. Installation Instructions:
 - a. Place sheet on desired surface.
 - b. Cut to length with utility knife.
 - c. Use PE Tape to seam multiple pieces together.
 - d. Use Blue painter's tape for wall anchoring.
 - e. Use Edge tape for floor anchoring.
- N. Plasti Shield Pro FR:
1. Features:
 - a. Fire Resistant.
 - b. 100 percent recyclable.
 - c. Strong and durable.
 - d. Lightweight.
 - e. Impact resistant.
 - f. Reusable.
 - g. Cost effective.
 - h. Hygienic.
 - i. Easy to convert.
 - j. Water resistant.
 2. Applications:
 - a. Construction.
 - b. Drywall.
 - c. Remodeling.
 - d. Painting.
 - e. Tuck Pointing.
 - f. Temporary Protection.
 3. Product Specifications:
 - a. Thickness: 0.16 inches (4 mm).
 - b. Thickness of inside flutes: 0.013 inches (0.34 mm).
 - c. Thickness of outside walls: 0.015 inches (0.39 mm).
 - d. Material: 100 percent polypropylene.
 - e. Density (grams/sq. meter): 1200 GSM.
 - f. Tensile Strength: MD: 245 lbf (1090 N). XD: 165 lbf (752 N).
 - g. Elongation: MD: 20 percent. XD: 10 percent.
 - h. Low Temperature Flex: Minus 20 degrees F (Minus 29 degrees C).
 - i. Dynamic Puncture: 20 J.
 - j. Avg. Compressive Strength: Flat-Wise: 212.8 psi (1467 kPa). Edge-Wise: 1,573 psi (10845 kPa).
 - k. Temperature (Ideal): 70 degrees F (21 degrees C).
 - l. Humidity (Ideal): 50 percent.
 - m. Chemical Name: Polypropylene Homopolymer or Copolymer.
 - n. Chemical Family: Polypropylene.
 - o. Chemical Formula: Proprietary.
 4. Available Size: PLS4493LBFR41200: Blue. 44 x 93 inches (1118 x 2362 mm).
 5. Handling and Storage: No special handling requirements. Product will not release hazardous chemicals under normal conditions of use.
 6. Installation Instructions:
 - a. Place sheet on desired surface.
 - b. Cut to length with utility knife.
 - c. Use Seam Tape FR to seam multiple pieces together.
 - d. Use Blue painter's tape for wall anchoring.
 - e. Use Edge tape for floor anchoring.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- O. Pro-Shield:
1. Features:
 - a. All-purpose hard surface protection.
 - b. Highly absorbent.
 - c. Leak-proof backing.
 - d. Slip-resistant, lightweight and flexible.
 - e. Keeps job site floors and counters safe from damage and debris.
 2. Applications:
 - a. Construction.
 - b. Remodeling.
 - c. Drywall.
 - d. Painting.
 - e. Temporary protection.
 3. Product Specifications:
 - a. Thickness: 2.0 mil (0.051 mm) nominal.
 - b. Covering: Non-Woven Polypropylene.
 - c. Backing: Polyethylene.
 - d. Absorption Level: 51 oz per sq yard (0.034 kg per sq m).
 - e. Tensile Strength: 325 to 405 psi (2241 to 2792 kPa).
 - f. Temperature (Ideal): 70 degrees F (21 degrees C).
 - g. Humidity (Ideal): 50 percent.
 - h. Elongation: 80 to 85 percent.
 - i. Chemical Name: n.a.
 - j. Chemical Family: Acrylic PSA Polyethylene.
 - k. Chemical Formula: Proprietary.
 - l. Trade Name: Pro Shield.
 - m. Material Use: Surface Protection.
 4. Available Sizes:
 - a. PS2420: Black, 24 inch (610 mm) x 20 ft (6.1 m) roll.
 - b. PS36536: Black, 36 inch (914 mm) x 50 ft (15.2 m) roll.
 - c. PS36100: Black, 36 inch (914 mm) x 100 ft (30.5 m) roll.
 - d. PS48100: Black, 48 inch (1219 mm) x 100 ft (30.5 m) roll.
 5. Handling and Storage: No special handling requirements.
 - a. Keep away from flammable and combustible material. Products will not release hazardous chemicals under normal conditions of use.
 6. Installation Instructions:
 - a. Flooring Installation: Before laying Pro Shield, thoroughly sweep area to remove dust and debris. Lay out Pro Shield to cover the whole area, cut to length as needed. Seam Pro Shield together with an appropriate adhesive tape.
- P. Pro Sheets:
1. Features:
 - a. Heavy-Duty temporary floor protection.
 - b. Exclusive Vapor-Cure technology.
 - c. Spill Guard technology.
 - d. Lays out fast.
 - e. Non-staining.
 - f. Recyclable.
 - g. Reusable.
 - h. FSC Certified.
 2. Applications:
 - a. Construction.
 - b. Drywall.
 - c. Moving.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- d. Painting.
 - e. Remodeling.
 - f. Parties.
 - g. Model Homes.
 - h. Temporary Protection.
3. Product Specifications:
- a. Caliper: 60 mil (nominal).
 - b. Moisture: Less than 6.5 percent.
 - c. Cobb (2 min): Top: 32. Bottom: 44.
 - d. Tensile Strength: MD: 433.42 lbf (1928 N). XD: 115.43 lbf (513 N).
 - e. Tear Resistance: MD: 475.68 lbf (2116 N). XD: 157.91 lbf (702 N).
 - f. Puncture Resistance: 77.74 lbf (346 N)..
 - g. Dynamic Puncture Resistance: 5 N
 - h. Permeability: Vapor permeable substrate.
 - i. Ideal Application Conditions: 60 to 80 degrees F (16 to 27 degrees C) with 30 to 50 percent relative humidity.
4. Available Sizes:
- a. RBPS48968X 48 x 96 inch (1219 x 2438 mm) sheet.
5. Handling and Storage: Store in a dry, cool and well-ventilated place away from open flame and other sources of ignition. Handle in accordance with good industrial hygiene and safety practice. Avoid contact with eyes. Ensure adequate ventilation. Avoid generation of dust. Do not breathe dust. Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Use spark-proof tools and explosion-proof equipment. Take precautionary measures against static discharges.
6. Installation Instructions:
- a. Sweep or vacuum all dirt and debris off surface to be covered.
 - b. Place sheets on surface as-needed.
 - c. Cut to desired length with utility knife.
 - d. Tape the seams (Ram Board Seam Tape).
 - e. When taping directly to the floor, consult the flooring manufacturer for recommended tape.
 - f. To reuse, sweep the surface and remove Pro Sheets.
- Q. Water Shield: Model No. WS60300 as manufactured by Surface Shields
1. Features:
- a. Non-staining.
 - b. Made from two strong kraft papers laminated with fiberglass scrim reinforcement.
 - c. Does not tear under normal traffic wear.
 - d. Protects hardwood, ceramic tile, marble, travertine and more.
2. Applications:
- a. Construction.
 - b. Remodeling.
 - c. Industrial.
 - d. Drywall.
 - e. Painting.
 - f. Temporary protection.
3. Product Specifications.
- a. Thickness: 9.0 mil (0.229 mm) nominal
 - b. Material: Kraft Paper, fiberglass.
 - c. Backing Type: n.a.
 - d. Adhesion Level: none.
 - e. Tensile Strength: n.a.
 - f. Temperature (Ideal): 70 degrees F (21 degrees C).
 - g. Humidity (Ideal): 50 percent.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- h. Elongation: n.a.
 - i. Chemical Name: Paper/fiberglass/hot melt.
 - j. Chemical Family: Paper/fiberglass/hot melt.
 - k. Chemical Formula: Proprietary.
 - l. Trade Name: Water Shield.
 - m. Material Use: Surface protection.
4. Available Sizes:
- a. WS36300: Natural, 36 inch (914 mm) x 300 ft (91.44 m), 25 lbs (11.43 kg).
 - b. WS48300: Natural, 48 inch (1219 mm) x 300 ft (91.44 m), 34 lbs (15.42 kg).
 - c. WS60300: Natural, 60 inch (1524 mm) x 300 ft (91.44 m), 42 lbs (19.05 kg).
 - d. WS72300: Natural, 72 inch (1829 mm) x 300 ft (91.44 m), 51 lbs (23.13 kg).
 - e. WS96300: Natural, 96 inch (2438 mm) x 300 ft (91.44 m), 65 lbs (29.48 kg).
5. Handling and Storage: Store at room temperature. Avoid high humidity environments.
6. Instructions: Before laying Water Shield, thoroughly sweep area to remove dust and debris. Place on desired surface and unroll. Cut to length with utility knife. Seam multiple pieces together with tape for larger areas. Do not adhere tape directly to floors. When finished, roll up Water Shield and discard. If Water Shield becomes damaged replace as needed.
- R. Window Shield by Surface Shields:
- 1. Features:
 - a. Self-adhering protective film for windows and glass.
 - b. Protects against overspray, mortar stains and stucco.
 - c. No more scraping and cleaning damage to the glass.
 - d. Saves time, labor and money.
 - 2. Applications:
 - a. Construction.
 - b. Remodeling.
 - c. Tuck Pointing.
 - d. Drywall.
 - e. Painting
 - f. Temporary Protection.
 - 3. Product Specifications:
 - a. Thickness:
 - 1) Short Term: 1.5 mil (0.038 mm) nominal.
 - 2) Long Term: 3.1 mil (0.079 mm) nominal.
 - b. Film:
 - 1) Short Term: Polyethylene w/UV Inhibitor.
 - 2) Long Term: PVC w/UV Inhibitor.
 - c. Adhesive: Type Water-based Acrylic
 - d. Adhesion Level:
 - 1) Short Term: 8.5 oz per inch.
 - 2) Long Term: 48 oz per inch.
 - e. Tensile Strength:
 - 1) Short Term: 2 to 3000 psi (13.8 to 20684 kPa).
 - 2) Long Term: 5100 psi (35163 kPa).
 - f. Temperature (Ideal): 70 degrees F (21 degrees C)
 - g. Humidity (Ideal): 50 percent
 - h. Elongation:
 - 1) Short Term: 300 to 400 percent.
 - 2) Long Term: 260 percent.
 - i. Chemical Name: Acrylic PSA tapes.
 - j. Chemical Family: Acrylic PSA polyethylene film.
 - k. Chemical Formula: Proprietary.
 - l. Trade Name: Window Shield.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- m. Material Use: Surface protection.
- 4. Available Sizes:
 - a. W2B12600: Blue 12 inch (305 mm) x 600 ft (182.9 m), 30 to 45 days, 2 pk.
 - b. W2B24250: Blue 24 inch (610 mm) x 250 ft (76.2 m), 30 to 45 days.
 - c. W2B24600: Blue 24 inch (610 mm) x 600 ft (182.9 m), 30 to 45 days.
 - d. W2C24600: Clear 24 inch (610 mm) x 600 ft (182.9 m), 30 to 45 days.
 - e. W2C36250: Clear 36 inch (914 mm) x 250 ft (76.2 m), 30 to 45 days.
 - f. W3C24600: Clear 24 inch (610 mm) x 600 ft (182.9 m), 90 to 180 days.
 - g. W4B24330: Blue 24 inch (610 mm) x 330 ft (100.6 m), PVC Long term (6 months to 1 year).
 - h. W4B36330: Blue 36 inch (914 mm) x 330 ft (100.6 m), PVC Long term (6 months to 1 year).
- 5. Handling and Storage: Store at room temperature and keep out of direct sunlight exposure. If Window Shield is stored in extreme conditions over 95 degrees F (35 degrees C) or below 40 degrees F (4.4 degrees C) allow product to return to room temperature prior to use.
- 6. Installation: Clean surface to remove any dust or debris. Place on desired surface and unroll. Cut to length with utility knife. When finished, roll up Window Shield and discard. If Window Shield becomes damaged replace with new Window Shield. Only leave Window Shield on glass per Window Shield model and instructions.

2.3 FLOOR AND WALL SEAMING TAPE

- A. Seaming Tape: Model No. RT 3-164 as manufactured by Ram Board. Used to cover Ram Board seams.
 - 1. Backing: Unique kraft backing tears easily and creates an extremely durable, smooth finish.
 - 2. Recyclable: 100 percent.
 - 3. Dimensions (W x L): 3 inch x 164 ft (76 mm x 50 m).
 - 4. Rolls per Box: 16.
- B. Vapor-Cure Tape: Model No. RB VCT 3-108 as manufactured by Ram Board. Used to cover Ram Board seams which prevents tape lines.
 - 1. Performance: Allows vapors and moisture to escape from concrete, glue down floors, stained floors, epoxy floors, refinished floors, vinyl composition tile, and most other floor types.
 - 2. Dimensions (W x L): 3 inch x 108 ft (76 mm x 32.9 m).
 - 3. Rolls per Box: 16.
- C. Edge Tape: Model No. RB ET 2.5-180 as manufactured by Ram Board. Used to secure Ram Board Temporary Floor Protection edges to flooring or wall surfaces.
 - 1. Performance: Easy Release, low tack tape for up to 14 days. Grips tightly to Ram Board while easy release on flooring surfaces up to 14 days.
 - 2. Dimensions (W x L): 2.5 inch x 180 ft (63.5 mm x 55 m).
 - 3. Rolls per Box: 20.

2.4 DOOR JAMB PROTECTION

- A. Door Jamb Protection: Model No. RBJP 60 or RBJP 36 Ram Jamb as manufactured by Ram Board. Heavy-duty flexible re-usable door jamb protection.
 - 1. Materials: Recycled and recyclable materials.
 - 2. Door Jamb Sizes: Fits 4 to 9 inch (102 to 229 mm).
 - 3. Length: 36 or 60 inch (914 or 1524 mm).
 - 4. Material Thickness: 65 mils (1.65 mm).

2.5 STAIR PROTECTION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Stair Armor: Stair Armor as manufactured by Ram Board. Heavy-duty stair protection.
 - 1. Features:
 - a. Standards Compliance: FSC certified. Recycled and recyclable materials.
 - b. Bull Nose Guard: Fold lines allowing Bull Nose protection.
 - c. Flex-Fiber Technology: Provides unmatched protection from impact while remaining flexible.
 - d. Vapor-Cure Technology: Allows protected substrates and finishes to cure while being protected so work may continue.
 - e. Spill Guard Technology: Provides added protection against water, paint, mud, and more.
 - f. Adjustable Tread: Designed to be used with different sized stair treads.
 - g. Non-staining.
 - h. Stair Protector Size: 34 x 19 inch (864 x 483 mm).
 - i. Self-adhering slip guard tape.
 - 2. Applications:
 - a. Construction.
 - b. Moving.
 - c. Remodeling.
 - d. Model homes.
 - e. Drywall.
 - f. Painting.
 - g. Temporary protection.
 - 3. Application Instructions:
 - a. Sweep or vacuum all debris and surfaced to be covered.
 - b. Place stair protection on stair with slip guard tape down. Use adjustable fold creases to ensure proper fit.
 - c. Fold bull nose down.
 - d. Tape edges of stair armor directly to stair.
 - e. Ensure product is securely bonded to substrate. Test prior to use.

2.6 CARPET PROTECTION

- A. Carpet Shield: Model No. CS36500 as manufactured by Surface Shields
 - 1. Features:
 - a. Self-adhering film designed to protect carpeting.
 - b. Protects clients' carpeting from damage claims while building, remodeling or painting.
 - c. Ideal protection during inclement weather.
 - d. Highly resistant to tears and punctures.
 - e. Protects all types of carpeting for up to 30 days.
 - 2. Applications:
 - a. Construction.
 - b. Moving.
 - c. Remodeling.
 - d. Model homes.
 - e. Drywall.
 - f. Painting.
 - g. Temporary protection.
 - 3. Product Specifications:
 - a. Thickness: 2.5 mil (0.063 mm) nominal.
 - b. Film: Low density polyethylene.
 - c. Adhesive Type: Formulated acrylic.
 - d. Adhesion Level: 17 to 25 oz per inch (0.48 to 0.71 kg per 25 mm).
 - e. Tensile Strength: 3000 psi (20684 kPa).
 - f. Temperature (Ideal): 70 degrees F (21 degrees C).

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- g. Humidity (Ideal): 50 percent.
 - h. Elongation MD: 350 to 500 percent.
 - i. Chemical Name: Acrylic PSA tapes.
 - j. Chemical Family: Acrylic PSA polyethylene film.
 - k. Chemical Formula: Proprietary.
 - l. Trade Name: Carpet Shield.
 - m. Material Use: Surface protection.
4. Available Sizes:
- a. CS2130W: Clear, 21 inch (533 mm) x 30 ft (9.14 m) 12 lbs (5.4 kg). Shelf display.
 - b. CS2450W: Clear, 24 inch (610 mm) x 50 ft (15.24 m), 18 lbs (8.2 kg). Shelf display.
 - c. CS24200L: Clear, 24 inch (610 mm) x 200 ft (60.96 m), 6 lbs (2.7 kg). Reverse wound.
 - d. CS24500: Clear, 24 inch (610 mm) x 500 ft (152.4 m), 15 lbs (6.8 kg). Reverse wound.
 - e. CS241000: Clear, 24 inch (610 mm) x 1000 ft (304.8 m), 30 lbs (13.6 kg). Reverse wound.
 - f. CS30200: Clear, 30 inch (762 mm) x 200 ft (60.96 m), 7.5 lbs (3.4 kg). Reverse wound.
 - g. CSR30200: Clear, 30 inch (762 mm) x 200 ft (60.96 m), 7.5 lbs (3.4 kg). Regular wound.
 - h. CS36200: Clear, 36 inch (914 mm) x 200 ft (60.96 m), 9 lbs (4.1 kg). Reverse wound.
 - i. CS36250: Clear, 36 inch (914 mm) x 250 ft (76.2 m), 11 lbs (5 kg). Reverse wound.
 - j. CS36500: Clear, 36 inch (914 mm) x 500 ft (152.4 m), 23 lbs (10.4 kg). Reverse wound.
 - k. CS361000: Clear, 36 inch (914 mm) x 1000 ft (305 mm), 45 lbs (20.4 kg). Reverse wound.
 - l. CS48500: Clear, 48 inch (1219 mm) x 500 ft (152.4 m), 35 lbs (15.9 kg). Reverse wound.
5. Handling and Storage: Do not apply to hardwood floors or other hard surfaces. Always test Carpet Shield on a small portion of carpet that is in a non-exposed area. 72-hour test required for use over adhesive installations. Temporary protection for up to 30 days. Recommended for synthetic carpeting only. Apply only to dry carpet, do not use under damp conditions.
6. Application Instructions: Before applying Carpet Shield, thoroughly clean and vacuum to remove dust and debris. Place on desired surface and unroll. Cut to length with utility knife. When finished, roll up Carpet Shield and discard. If Carpet Shield becomes damaged replace with new Carpet Shield. Replace Carpet Shield every 30 days. Do not apply Carpet Shield to wool based carpet. Follow all installation methods and instructions that come with Carpet Shield.
- B. Carpet Mask: Model No. CM435 as manufactured by Surface Shields
- 1. Features:
 - a. Self-adhering film designed to protect carpeting.
 - b. Protects clients' carpeting from damage claims while building, remodeling or painting.
 - c. Ideal protection during inclement weather.
 - d. Highly resistant to tears and punctures.
 - e. Protects all types of carpeting for up to 30 days.
 - 2. Applications:
 - a. Construction.
 - b. Moving.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- c. Remodeling.
 - d. Model Homes.
 - e. Drywall.
 - f. Painting.
 - g. Temporary Protection.
 - 3. Product Specifications.
 - a. Thickness: 3 mil (0.076 mm) nominal,
 - b. Film: Low density polyethylene
 - c. Adhesion Type: Solvent acrylic.
 - d. Adhesion Level: 22 oz per inch (0.62 kg per 25 mm).
 - e. Tensile Strength: 2500 psi (17237 kPa).
 - f. Temperature (Ideal): 70 degrees F (21 degrees C).
 - g. Humidity (Ideal): 50 percent.
 - h. Elongation MD: 300 to 500 percent.
 - i. Chemical Name: Acrylic PSA tapes.
 - j. Chemical Family: Acrylic PSA polyethylene film.
 - k. Chemical Formula: Proprietary.
 - l. Trade Name: Carpet mask.
 - m. Material Use: Surface protection.
 - 4. Available Sizes:
 - a. CM230: Tint, 21 inch (533 mm) x 200 ft (60.96 m), 3 mil (0.076 mm).
 - b. CMS230: Clear, 21 inch (533 mm) x 200 ft (60.96 m), 3 mil (0.076 mm).
 - c. CM232: Clear, 21 inch (533 mm) x 500 ft (152.4 m), 3 mil (0.076 mm).
 - d. CM235: Tint, 21 inch (533 mm) x 1000 ft (304.8 m), 3 mil (0.076 mm).
 - e. CM335: Clear, 24 inch (610 mm) x 200 ft (60.96 m), 3 mil (0.076 mm).
 - f. CM340: Clear, 24 inch (610 mm) x 200 ft (60.96 m), 3 mil (0.076 mm).
 - g. CMR341: Clear, 24 inch (610 mm) x 200 ft (60.96 m), 1.8 mil (0.046 mm).
 - h. CM365: Clear, 24 inch (610 mm) x 500 ft (152.4 m), Clear, 3 mil (0.076 mm).
 - i. CM375: Clear, 24 inch (610 mm) x 1000 ft (304.8 m), Clear, 3 mil (0.076 mm).
 - j. CM410: Clear, 30 inch (762 mm) x 200 ft (60.96 m), Clear, 3 mil (0.076 mm).
 - k. CM420: Tint, 36 inch (914 mm) x 200 ft (60.96 m), 3 mil (0.076 mm).
 - l. CM425: Clear, 36 inch (914 mm) x 200 ft (60.96 m), 3 mil (0.076 mm).
 - m. CM435: Clear, 36 inch (914 mm) x 500 ft (152.4 m), 3 mil (0.076 mm).
 - n. CM440: Clear 36 inch (914 mm) x 500 ft (152.4 m), 3 mil (0.076 mm).
 - o. CM515: Tint, 48 inch (1219 mm) x 500 ft (152.4 m), 3 mil (0.076 mm).
 - p. CM520: Clear, 48 inch (1219 mm) x 500 ft (152.4 m), 3 mil (0.076 mm).
 - q. CM530: Clear, 48 inch (1219 mm) x 1000 ft (304.8 m), 3 mil (0.076 mm).
 - 5. Handling and Storage: Peel back edge of Carpet Mask and begin to unroll. Press down edge at beginning of area to be covered so Carpet Mask adheres. Continue rolling onto carpet, applying pressure and smoothing down the 1m while doing so. Carefully cut end with a sharp edge. When finished, fold edge of the 1m back against the roll to use at a later time. Removal: roll up Carpet Mask and discard.
 - 6. Application Instructions: Do not apply to hardwood doors or other hard surfaces. Always test Carpet Mask on a small portion of carpet that is in a non-exposed area. 72 hour test required for installations. Temporary protection for up to 30 days. Recommended for synthetic carpeting only. Apply only to dry carpet, do not use under damp conditions.
- C. Carpet Mask FR: Model No. CM627 as manufactured by Surface Shields
- 1. Features:
 - a. Specialty self-adhering film designed to protect carpeting when flame retardant properties are needed.
 - b. Protects clients' carpeting from damage claims while repairing and inspecting passenger and industrial ships.
 - c. Ideal protection during inclement weather.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- d. Highly resistant to tears and punctures.
- e. Protects all types of carpeting for up to 30 days.
2. Applications:
 - a. Marine.
 - b. Moving.
 - c. Remodeling.
 - d. Model homes.
 - e. Drywall.
 - f. Painting.
 - g. Construction.
 - h. Temporary protection.
3. Product Specifications:
 - a. Thickness: 4 mil (0.102 mm) nominal.
 - b. Film: Low density polyethylene with fire retardant.
 - c. Adhesive Type: Solvent acrylic.
 - d. Adhesion Level: 12 oz per inch (0.34 kg per 25 mm) nominal.
 - e. Tensile Strength: 2500 psi (17237 kPa).
 - f. Temperature (Ideal): 70 degrees F (21 degrees C).
 - g. Humidity (Ideal): 50 percent.
 - h. Elongation MD: 300 to 500 percent.
 - i. Extinguish critical flux 30.9.
 - j. Sustained burning heat 1.93.
4. Available Sizes:
 - a. CM625: Clear, 36 inch (914 mm) x 300 ft (91.4 m), fire resistant.
 - b. CM627: 48 inch (1219 mm) x 300 ft (91.4 m), fire resistant.
5. Handling and Storage: Peel back edge of Carpet Mask and begin to unroll. Press down edge at beginning of area to be covered so Carpet Mask adheres. Continue rolling onto carpet, applying pressure and smoothing down the 1m while doing so. Carefully cut end with a sharp edge. When finished, fold edge of the film back against the roll to use at a later time. Removal: roll up Carpet Mask and discard.
6. Application Instructions: Do not apply to hardwood floors or other hard surfaces. Always test Carpet Mask on a small portion of carpet that is in a non-exposed area. 72 hour test required for installations. Temporary protection for up to 30 days. Recommended for synthetic carpeting only. Apply only to dry carpet, do not use under damp conditions.

2.7 DUST CONTAINMENT

- A. Clean Mats by Surface Shields: Model No. CM2436B4.
 1. Features:
 - a. Tacky surface mat to remove dust and dirt from footwear.
 - b. Mat contains 30 tabbed sheets for easy removal.
 - c. Prevents dust and dirt from spreading while building or remodeling.
 - d. Do not adhere to carpeted surfaces.
 2. Applications:
 - a. Construction.
 - b. Remodeling.
 - c. Warehouse.
 - d. Drywall.
 - e. Industrial.
 - f. Temporary Protection.
 3. Product Specifications:
 - a. Thickness: 2.0 mil (0.051 mm) nominal.
 - b. Film: Low density polyethylene.
 - c. Adhesive Type: Water based acrylic.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- d. Adhesion Level: 14 to 18 oz per inch (0.40 to 0.51 kg per 25 mm).
 - e. Tensile Strength 150 lbs per inch (68 kg per 25 mm).
 - f. Temperature (Ideal) 70 degrees F (21 degrees C).
 - g. Humidity (Ideal) 50 percent.
 - h. Elongation 250 to 300 percent.
 - i. Chemical Family: Polyethylene film.
 - j. Chemical Formula: Proprietary.
 - k. Trade Name: Clean Mat.
 - l. Material Use: Surface protection.
4. Available Sizes:
- a. CM1836B4: Blue, 18 x 36 inch (457 x 914 mm), 4 pack, 7 lbs (3.15 kg).
 - b. CM1836W4: White, 18 x 36 inch (457 x 914 mm), 4 pack, 7 lbs (3.15 kg).
 - c. CM1845B4: Blue, 18 x 45 inch (457 x 1143 mm), 4 pack, 8 lbs (3.63 kg).
 - d. CM1845W4: White, 18 x 45 inch (457 x 1143 mm), 4 pack, 8 lbs (3.63 kg).
 - e. CM2436B4: Blue, 24 x 36 inch (610 x 914 mm), 4 pack, 9 lbs (4.08 kg).
 - f. CM2436W4: White, 24 x 36 inch (610 x 914 mm), 4 pack, 9 lbs (4.08 kg).
 - g. CM2445B4: Blue, 24 x 45 inch (610 x 1143 mm), 4 pack, 11 lbs (5 kg).
 - h. CM2445W4: White, 24 x 45 inch (610 x 1143 mm), 4 pack, 11 lbs (5 kg).
 - i. CM3636B4: Blue, 36 x 36 inch (914 x 914 mm), 4 pack, 13 lbs (5.90 kg).
 - j. CM3636W4: White, 36 x 36 inch (914 x 914 mm), 4 pack, 13 lbs (5.90 kg).
 - k. CM3645B4: Blue, 36 x 45 inch (914 x 1143 mm), 4 pack, 16 lbs (7.26 kg).
 - l. CM3645W4: White, 36 x 45 inch (914 x 1143 mm), 4 pack, 16 lbs (7.26 kg).
5. Handling and Storage: Store at room temperature. Do not store in extreme conditions over 95 degrees F (35 degrees C) or below 40 degrees F (4.4 degrees C).
6. Installation: Place Clean Mat at the entrance/exit of the jobsite to remove dust and debris before entering the jobsite. Replace tabbed sheet as needed. Do not apply Clean Mat on finished surfaces.
- B. Duct Cover Shield: Model No. DCR36200B as manufactured by Surface Shields
- 1. Features:
 - a. Self-adhering protective film for HVAC ducts.
 - b. Very high adhesion for all types of ductwork.
 - c. Will not leave a residue on metal after removal.
 - d. Highly resistant to tears and punctures.
 - 2. Applications:
 - a. Construction.
 - b. HVAC.
 - c. Remodeling.
 - d. Closures.
 - e. Mechanical.
 - f. Temporary protection.
 - 3. Product Specifications:
 - a. Thickness: 3.0 mil (0.076 mm) nominal.
 - b. Film: Low density polyethylene.
 - c. Adhesive Type: Water based acrylic.
 - d. Adhesion Level: 12.7 oz per inch (0.36 kg per 25 mm).
 - e. Tensile Strength 2800 psi (19305 kPa).
 - f. Temperature (Ideal) 70 degrees F (21 degrees C).
 - g. Humidity (Ideal) 50 percent.
 - h. Elongation 525 percent.
 - i. Chemical Family: Polyethylene film.
 - j. Chemical Formula: Proprietary.
 - k. Trade Name: Dust cover shield.
 - l. Material Use: Temporary closures.
 - 4. Available Sizes:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. DCR318200B: Blue 18 x 200 inch (457 x 5080 mm) 5 lbs (2.27 kg).
 - b. DCR324200B: Blue 24 x 200 inch (610 x 5080 mm) 6 lbs (2.72 kg).
 - c. DCR24200: Clear 24 x 200 inch (610 x 5080 mm) 6 lbs (2.72 kg).
 - d. DCR336200B: Blue 36 x 200 inch (914 x 5080 mm) 9 lbs (4.08 kg).
 - e. DCR36200: Clear 36 x 200 inch (914 x 5080 mm) 9 lbs (4.08 kg).
 - f. DCR348200B: Blue 48 x 200 inch (1219 x 5080 mm) 12 lbs (5.44 kg).
5. Handling and Storage: Store at room temperature. If Duct Cover Shield is stored in extreme conditions over 95 degrees F (35 degrees C) or below 40 degrees F (4.4 degrees C) allow product to return to room temperature prior to use.
 6. Installation: Clean surface of ductwork before applying Duct Shield. Remove upon substantial completion of the jobsite, or when ductwork will be made inaccessible.
- C. Dust Shield Pro: Model No. DSPRO20 or DSPRO2 as manufactured by Surface Shields.
1. Features:
 - a. Makes constructing temporary walls quick and affordable.
 - b. Heavy gauge aluminum prevents dents.
 - c. Locking head ensures that poly sheeting will not slip out.
 - d. Adjustable poles are available in 10, 12, and 20 ft (3048, 3658, and 6096 mm) lengths.
 - e. 360-degree swivel foot for use on floors and angled ceilings.
 - f. Custom printed bags available.
 - g. Micro adjust feature increases tension against the ceiling.
 2. Applications:
 - a. Construction.
 - b. Remodeling.
 - c. Dust containment.
 - d. Painting.
 - e. Temporary protection.
 3. Product Specifications:
 - a. Thickness: n.a.
 - b. Bulk Material: Aluminum.
 - c. Head/Foot Material: Plastic/rubber.
 - d. Tensile Strength: n.a.
 - e. Temperature (Ideal): 70 degrees F (21 degrees C).
 - f. Humidity (Ideal): 50 percent.
 - g. Elongation: n.a.
 - h. Chemical Name: n.a.
 - i. Chemical Family: n.a.
 - j. Chemical Formula: Proprietary.
 - k. Trade Name: Dust Shield PRO Poles.
 - l. Material Use: Surface protection/dust containment.
 4. Available Sizes:
 - a. DSPRO2: Red. Poles adjust up to 12 ft (3.7 m). 8 lbs (3.63 kg).
 - b. DSPRO20: Red. Poles adjust up to 20 ft (6.1 m). 12 lbs (5.44 kg).
 5. Handling and Storage: Store at room temperature.
 6. Installation: Construct Temporary Dust Containment barriers using Dust Shield Pro Poles and Zip N Close adhesive zippers. Use a jobsite approved poly sheeting. To ensure a tight seal use a Dust Shield Pro Pole every 4 to 6 ft (1219 to 1829 mm).
- D. Step-N-Peel Clean Mats by Surface Shields: Model No. DG30W
1. Features:
 - a. Protects floors from dirt, scuffs and heel marks.
 - b. Elastic closure.
 - c. Lightweight and breathable.
 - d. Cost effective protection for any surface.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- e. Available in cloth and PE coated materials.
 2. Applications:
 - a. Construction.
 - b. Laboratory.
 - c. Moving.
 - d. Temporary protection.
 - e. Industrial.
 - f. Remodeling.
 - g. Warehouse.
 3. Product Specifications:
 - a. Thickness: 2.0 mil nominal.
 - b. Film: Polyethylene.
 - c. Adhesive Type: Water-based acrylic.
 - d. Adhesion Level: 14.0 to 18.0 oz per inch (0.4 to 0.5 kg).
 - e. Tensile Strength: 2000 to 3000 psi (13789 to 20684 kPa).
 - f. Temperature (Ideal): 70 degrees F (21 degrees C).
 - g. Humidity (Ideal): 50 percent.
 - h. Elongation: 300 to 400 percent.
 - i. Chemical Name: Polyethylene / acrylic.
 - j. Chemical Family: Polyethylene / acrylic.
 - k. Chemical Formula: Proprietary.
 - l. Trade Name: Step N Peel.
 - m. Material Use: Surface protection.
 4. Available Sizes:
 - a. DG30WM: White Frame, 25.5 x 31.5 inch (648 x 800 mm) 30 Sheets, 7 lbs (3.15 kg).
 - b. DGRCM: Refill, 24 x 30 inch (610 x 762 mm) 30 Sheets, 2 lbs (0.91 kg).
 - c. DG30W: White Frame, 25.5 x 31.5 inch (648 x 800 mm) 30 Sheets, 7 lbs (3.15 kg).
 - d. DGRC: Refill, 24 x 30 inch (610 x 762 mm) 30 Sheets 2 lbs (0.91 kg).
 - e. DG60W: White Frame, 25.5 x 31.5 inch (648 x 800 mm) 60 Sheets, 10 lbs (4.53 kg).
 - f. DGRC60: Refill, 24 x 30 inch (610 x 762 mm) 60 Sheets 4.5 lbs (2.04 kg).
 - g. DGC: Custom Print (min 12) 30 Sheets 7 lbs (3.15 kg).
 5. Handling and Storage: Store at room temperature. Do not store in extreme conditions over 95 degrees F (35 degrees C) or below 40 degrees F (4.4 degrees C).
 6. Installation: Place Step N Peel at the entrance/exit of the jobsite to remove dust and debris before entering the jobsite. Replace tabbed sheet as needed.
- E. Vent Mask by Surface Shields:
1. Features:
 - a. Keeps dust and debris from entering floor or wall registers during construction or work.
 - b. Individual perforated sheets for easy application.
 - c. Medium tack / residue free.
 2. Applications:
 - a. Construction.
 - b. Remodeling.
 - c. Residential.
 - d. Drywall.
 - e. Painting.
 - f. Temporary protection.
 3. Product Specifications:
 - a. Thickness: n.a.
 - b. Film: Polyethylene.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- c. Adhesive Type: Water-based acrylic.
 - d. Adhesion Level: n.a.
 - e. Tensile Strength: n.a.
 - f. Temperature (Ideal): 70 degrees F (21 degrees C).
 - g. Humidity (Ideal): 50 percent.
 - h. Elongation: n.a.
 - i. Chemical Name: Polyethylene.
 - j. Chemical Family: Polyethylene film.
 - k. Chemical Formula: Proprietary.
 - l. Trade Name: Vent mask.
 - m. Material Use: Surface protection.
4. Available Sizes:
- a. VMC12200P8: Clear, 12 inch (305 mm) x 200 ft (60.96 m) perforations every 8 inches (203 mm), 2 lbs (0.91 kg).
 - b. VMB08185P4: Blue, 8 inch (203 mm) x 185 ft (56.39 m) perforations every 4 inches (102 mm), 1.5 lbs (0.68 kg).
 - c. VMB13185P13: Blue, 13 inch (330 mm) x 185 ft (56.39 m) perforations every 13 inches (330 mm), 2 lbs (0.91 kg).
5. Handling and Storage: Store at room temperature. Avoid high humidity environments.
6. Installation: Clean surface of Vent before applying Vent Shield. Remove upon substantial completion of the jobsite, when ductwork will be made inaccessible or during testing. Do Not Apply to Wooden vent covers.
- F. Zip N Close Zippers by Surface Shields: Model No. ZC02.
1. Features:
- a. Creates instant access to tarps or plastic enclosures.
 - b. Pressure sensitive adhesive backing.
 - c. Can be opened from either side.
 - d. Use 1 zipper for a flap or 2 for a wider opening.
 - e. Zippers: 2 per package.
2. Applications:
- a. Construction.
 - b. Dust containment.
 - c. Remodeling.
 - d. Temporary walls.
 - e. Drywall.
 - f. Painting.
 - g. Abatement.
3. Product Specifications:
- a. Thickness: n.a.
 - b. Adhesion Level: n.a.
 - c. Density: n.a.
 - d. Tensile Strength: n.a.
 - e. Temp Resistance: n.a.
 - f. Elongation: n.a.
 - g. Critical Temperature: n.a.
 - h. Cloth Material: Polyester - 300D.
 - i. Teeth Material: Polyester.
 - j. Teeth Size: 0.029 inch (0.74 mm) diameter.
 - k. Head Material: Zinc Alloy.
 - l. Adhesive: Styrene butadiene, styrene isoprene.
 - m. Trade Name: Zip N Close Zippers.
 - n. Material Use: Surface protection.
4. Available Sizes:
- a. ZA02: Red, 1.5 inch (38 mm) x 7 ft (2134 mm), 10 oz (0.28 kg).

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- b. ZC02: Blue, 2.75 inch (70 mm) x 7 ft (2143 mm), 1 lb (0.45 kg).
- 5. Handling and Storage: Ensure good ventilation and exhaustion at the workplace. Keep respiratory protective devices available. Store in a cool location away from fire and heat. No special handling requirements.
- 6. Installation: Construct Temporary Dust Containment barriers using Dust Shield Pro Poles and Zip N Close adhesive zippers. Use a jobsite approved poly sheeting. To ensure a tight seal use a Dust Shield Pro Pole every 4 to 6 ft (1219 to 1929 mm).

2.8 SPECIALTY ITEMS

- A. Marble Shield: Model No. MA536600 as manufactured by Surface Shields.
 - 1. Features:
 - a. Self-adhering film designed to protect marble.
 - b. Protects cultured marble and cast polymer from chips and scratches.
 - c. Provides an excellent moisture barrier and resists ripping and tearing.
 - 2. Applications:
 - a. Construction.
 - b. Counter tops.
 - c. Remodeling.
 - d. Drywall.
 - e. Painting.
 - f. Parties.
 - 3. Product Specifications:
 - a. Film: Low density polyethylene.
 - b. Adhesive Type: Formulated acrylic.
 - c. Adhesion Level: 5 oz per inch (0.14 kg per 25 mm).
 - d. Tensile Strength: 1500 psi (10342 kPa).
 - e. Temperature (Ideal): 70 degrees F (21 degrees C).
 - f. Humidity (Ideal): 50 percent.
 - g. Elongation: 450 percent.
 - h. Chemical Name: Acrylic PSA tapes.
 - i. Chemical Family: Acrylic PSA polyethylene film.
 - j. Chemical Formula: Proprietary.
 - k. Trade Name: Marble Shield.
 - l. Material Use: Surface protection.
 - 4. Available Sizes:
 - a. MA324600: Clear, 24 inch (610 mm) x 600 ft (182.9 m) 16 lbs (7.26 kg). 3 mil (0.076 mm) thick.
 - b. MA336600: Clear, 36 inch (914 mm) x 600 ft (182.9 m) 24 lbs (10.89 kg). 3 mil (0.076 mm) thick.
 - c. MA524600: Clear, 24 inch (610 mm) x 600 ft (182.9 m) 33 lbs (14.97 kg). 5 mil (0.127 mm) thick.
 - d. MA536600: Clear, 36 inch (914 mm) x 600 ft (182.9 m) 49 lbs (22.23 kg). 5 mil (0.127 mm) thick.
 - 5. Handling and Storage: Recommended for marble finishes, smooth polycarbonate, medium polish stainless steel, smooth laminates, anodized aluminum, and painted metals. Ideal for use during fabrication and/or shipping where heavy-duty protection is required. Helps protect cultured marble and cast polymer from chips and scratches during shipping and installation.
 - 6. Installation: Clean surface to remove any dust or debris. Place on desired surface and unroll. Cut to length with utility knife. When finished, roll up Marble Shield and discard. If Marble Shield becomes damaged replace with new Marble Shield.
- B. Entry Shield by Surface Shields:
 - 1. Features:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Protects door frame from accidental scratches and dents.
- b. Available in paperboard or plastic.
- c. Snaps around door casings 6 to 8 inch (152 to 203 mm) thick.
2. Applications:
 - a. Construction.
 - b. Commercial.
 - c. Remodeling.
 - d. Residential.
 - e. Moving.
 - f. Temporary protection.
 - g. Industrial.
3. Product Specifications:
 - a. Thickness: n.a.
 - b. Material: Plastic, cardboard.
 - c. Tensile Strength: n.a.
 - d. Temperature (Ideal): 70 degrees F (21 degrees C).
 - e. Humidity (Ideal): 50 percent.
 - f. Elongation: n.a.
 - g. Chemical Name: Plastic, cardboard.
 - h. Chemical Family: Plastic, cardboard.
 - i. Chemical Formula: Proprietary.
 - j. Trade Name: Entry shield.
 - k. Material Use: Surface protection.
 - l. Environmental: Recyclable, reusable.
4. Available Sizes:
 - a. ES45P10: Gray, 6 x 45 inch (152 x 1143 mm), 14 oz (0.40 kg).
 - b. ES6048C50: Natural, 4 to 8 x 60 inch (102 to 203 x 1524 mm), 2 lbs (0.91 kg).
 - c. ES72P10: Gray, 6 x 72 inch (152 x 1829 mm), 1.5 lbs (0.68 kg).
 - d. ES728P8: Gray, 8 x 72 inch (203 x 1829 mm), 2 lbs (0.91 kg).
5. Handling and Storage: Store at room temperature, protect as needed.
6. Installation: Place Entry Shield on every installed door jamb on the jobsite. Remove upon substantial completion.

2.9 ADHESIVE TAPE

- A. Danger Tape:
 1. Description: Danger tape is a necessity for construction sites with hazardous areas that require perimeter marking. It's made with a tough and tear resistant polyethylene plastic. Available in English and Spanish.
 2. Product Specifications:
 - a. Available Colors: Red.
 - b. Tape Size: 3 inch (76 mm).
 - c. Recyclable: Yes.
 - d. Reusable: Yes.
 - e. Breathable: No.
 - f. Adhesive: No.
 - g. Liquid Resistant: Yes.
 - h. Flame Retardant: No.
- B. Builder Board Tape:
 1. Description: The perfect tape to compliment Builder Board with Liquid Shield Technology. It has an aggressive, high tack adhesive that can seam Builder Board together for months. It's strong, flexible and lays flat.
 2. Product Specifications:
 - a. Available Colors: Natural.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- b. Recyclable: No.
 - c. Reusable: No.
 - d. Breathable: No.
 - e. Adhesive: Yes.
 - f. Liquid Resistant: Yes.
 - g. Flame Retardant: No.
- C. Builder Board Breathable Tape:
- 1. Description: Prevent cure lines and let vapors escape by seaming with the strong, tacky hold of Builder Board Breathable Tape.
 - 2. Product Specifications:
 - a. Available Colors: Natural.
 - b. Recyclable: Yes.
 - c. Reusable: No.
 - d. Breathable: Yes.
 - e. Adhesive: No.
 - f. Liquid Resistant: No.
 - g. Flame Retardant: No.
- D. Drywall Mesh Tape by Surface Shields:
- 1. Description: Drywall mesh tape is a self-adhesive fiberglass tape. Seam drywall joints and mask for stucco application. Patch Pro tape is available in sizes ranging from 2 to 36 inches (51 to 914 mm) wide.
 - 2. Product Specifications:
 - a. Available Colors: Blue, white, yellow.
 - b. Recyclable: No.
 - c. Reusable: No.
 - d. Breathable: Yes.
 - e. Adhesive: Yes.
 - f. Liquid Resistant: No.
 - g. Flame Retardant: No.
- E. Painters Grade Blue Tape by Surface Shields:
- 1. Description: A versatile, 5 mil tape that's easy to use and conforms to a variety of surfaces. It has a synthetic rubber adhesive that peels off easily.
 - 2. Product Specifications:
 - a. Available Colors: Blue.
 - b. Recyclable: No.
 - c. Reusable: No.
 - d. Breathable: No.
 - e. Adhesive: Yes.
 - f. Liquid Resistant: Yes.
 - g. Flame Retardant: No.
- F. Armbar PE Tape by Surface Shields:
- 1. Description: Developed for superior hold to leading competitors and engineered with exclusive quick release. Armbar pro grade poly tape is ideal for stucco, surface protection and dust containment applications.
 - 2. Product Specifications:
 - a. Available Colors: Red.
 - b. Tape Size: 2 inch (50 mm).
 - c. Recyclable: No.
 - d. Reusable: No.
 - e. Breathable: No.
 - f. Adhesive: Yes.
 - g. Liquid Resistant: Yes.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- h. Flame Retardant: No.
 - i. Flame Retardant: No.
- G. Ultrastik by Surface Shields:
- 1. Description: Ultrastik is a double sided, scrim reinforced acrylic adhesive tape. It's ideal for applying base trim, mounting of vinyl, plastic and wooden molding. It's also non-toxic and bonds to most materials.
 - 2. Product Specifications:
 - a. Available Colors: Clear.
 - b. Recyclable: No.
 - c. Reusable: No.
 - d. Breathable: No.
 - e. Adhesive: Yes.
 - f. Liquid Resistant: No.
 - g. Flame Retardant: No.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Examine substrates for compliance with requirements for installation. Proceed with installation or protection products only after unsatisfactory conditions have been corrected
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.4 PROTECTION

- A. Protection installed products may be left in place until completion of project or adjacent work.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 1: GENERAL REQUIREMENTS
Section 01 60 00: Product Requirements

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.
- B. Related Sections include the following:
 - 1. Division 1 Section "Allowances" for products selected under an allowance.
 - 2. Division 1 Section "Alternates" for products selected under an alternate.
 - 3. Division 1 Section "References" for applicable industry standards for products specified.
 - 4. Division 1 Section "Project Closeout" for submitting warranties for Contract closeout.
 - 5. Divisions 2 through 16 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
- C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.4 SUBMITTALS

- A. Product List: Submit a list, in tabular form, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
 2. Form: Tabulate information for each product under the following column headings:
 - a. Specification Section number and title.
 - b. Generic name used in the Contract Documents.
 - c. Proprietary name, model number, and similar designations.
 - d. Manufacturer's name and address.
 - e. Supplier's name and address.
 - f. Installer's name and address.
 - g. Projected delivery date or time span of delivery period.
 - h. Identification of items that require early submittal approval for scheduled delivery date.
 3. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.
 - a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.
 4. Completed List: Within 60 days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
 5. Architect's Action: Architect will respond in writing to Contractor within 15 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.
- B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Substitution Request Form: Use the Prior Approval Form bound in these specifications.
 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified material or product cannot be provided.
 - b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
 - i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
 - j. Cost information, including a proposal of change, if any, in the Contract Sum.
 - k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
 - l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
- 3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
 - a. Form of Acceptance: Change order.
 - b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.
- C. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval of proposed comparable product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
 - a. Form of Approval: As specified in Division 1 Section "Submittals."
 - b. Use product specified if Architect cannot make a decision on use of a comparable product request within time allocated.
- D. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 1 Section "Submittals." Show compliance with requirements.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.
 - 1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 - 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
- C. Storage:
 - 1. Store products to allow for inspection and measurement of quantity or counting of units.
 - 2. Store materials in a manner that will not endanger Project structure.
 - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 4. Store cementitious products and materials on elevated platforms.
 - 5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 7. Protect stored products from damage and liquids from freezing.
 - 8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
 3. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Division 1 Section "Project Closeout."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
 6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
 7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures:
1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
 3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
 4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
 - a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.
10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.
 - a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
 - b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

- A. Timing: Architect will consider requests for substitution if received within 15 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.
- B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 2. Requested substitution does not require extensive revisions to the Contract Documents.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's Construction Schedule.
6. Requested substitution has received necessary approvals of authorities having jurisdiction.
7. Requested substitution is compatible with other portions of the Work.
8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.
10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

2.3 COMPARABLE PRODUCTS

- A. Conditions: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 1: GENERAL REQUIREMENTS
Section 01 71 23: Field Engineering

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. General: This Section specifies administrative and procedural requirements for field engineering services, including, but not necessarily limited to, the following:
 - 1. Land survey Work.
 - 2. Civil engineering services.
 - 3. Structural engineering services.
 - 4. Existing conditions dimension verification.

1.3 SUBMITTALS

- A. Certificates: Submit a certificate signed by the Land Surveyor or Professional Engineer certifying that the location and elevation of improvements comply with the Contract Documents.
- B. Final Property Survey: Submit 10 copies of the final property survey.
- C. Project Record Documents: Submit a record of Work performed and record survey data as required under provisions of Sections "Submittals" and "Project Closeout".

1.4 QUALITY ASSURANCE

- A. Surveyor: Engage a Registered Land Surveyor registered in the State where the project is located, to perform land surveying services required.
- B. Engineer: Engage a Professional Engineer of the discipline required, registered in the state in which the Project is located, to perform required engineering services.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. The Owner will identify existing control points and property line corner stakes.
- B. Verify existing and new layout information shown on the Drawings, in relation to the property survey and existing benchmarks before proceeding to layout the Work. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction.
 - 1. Do not change or relocate benchmarks or control points without prior written approval. Promptly report lost or destroyed reference points, or requirements to relocate reference

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- points because of necessary changes in grades or locations.
 2. Promptly replace lost or destroyed project control points. Base replacements on the original survey control points.
- C. Establish and maintain a minimum of two permanent benchmarks on the site, referenced to data established by survey control points.
1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
- D. Existing utilities and equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction.
1. Prior to construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer and water service piping.

3.2 PERFORMANCE

- A. Working from lines and levels established by the property survey, establish benchmarks and markers to set lines and levels at each story of construction and elsewhere as needed to properly locate each element of the Project. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale Drawings to determine dimensions.
1. Advise entities engaged in construction activities, of marked lines and levels provided for their use.
 2. As construction proceeds, check every major element for line, level and plumb.
- B. Surveyor's Log: Maintain a surveyor's log of control and other survey Work. Make this log available for reference.
1. Record deviations from required lines and levels, and advise the Architect when deviations that exceed indicated or recognized tolerances are detected. On Project Record Drawings, record deviations that are accepted and not corrected.
 2. On completion of foundation walls, major site improvements, and other Work requiring field engineering services, prepare a certified survey showing dimensions, locations, angles and elevations of construction and sitework.
- C. Site Improvements: Locate and lay out site improvements, including pavements, stakes for grading, fill and topsoil placement, utility slopes and invert elevations by instrumentation and similar appropriate means.
- D. Building Lines and Levels: Locate and lay out batter boards for structures, building foundations, column grids and locations, floor levels and control lines and levels required for mechanical and electrical Work.
- E. Existing Utilities: Furnish information necessary to adjust, move or relocate existing structures, utility poles, lines, services or other appurtenances located in, or affected by construction. Coordinate with local authorities having jurisdiction.
- F. Final Property Survey: Before Substantial Completion, prepare a final property survey showing significant features (real property) for the Project. Include on the survey a certification, signed by the Surveyor, to the effect that principal metes, bounds, lines and levels of the Project are

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

accurately positioned as shown on the survey.

1. Recording: At Substantial Completion, have the final property survey recorded by or with local governing authorities as the official "property survey".

END OF SECTION 01 71 23

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 1: GENERAL REQUIREMENTS
Section 01 73 29 - Cutting and Patching

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section.

1.2 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
- B. Related Sections include the following:
 - 1. Divisions 5 through 16 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
 - 2. Division 7 Section "Firestopping" for patching fire-rated construction.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
 - 1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
 - 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
 - 3. Products: List products to be used and firms or entities that will perform the Work.
 - 4. Dates: Indicate when cutting and patching will be performed.
 - 5. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.
 - 6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
 - 7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1.5 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include the following:
 - 1. Primary operational systems and equipment.
 - 2. Air or smoke barriers.
 - 3. Fire-suppression systems.
 - 4. Mechanical systems piping and ducts.
 - 5. Control systems.
 - 6. Communication systems.
 - 7. Conveying systems.
 - 8. Electrical wiring systems.
 - 9. Operating systems of special construction in Division 13 Sections.
- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that result in increased maintenance or decreased operational life or safety. Miscellaneous elements include the following:
 - 1. Water, moisture, or vapor barriers.
 - 2. Membranes and flashings.
 - 3. Exterior curtain-wall construction.
 - 4. Equipment supports.
 - 5. Piping, ductwork, vessels, and equipment.
 - 6. Noise- and vibration-control elements and systems.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.6 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
 - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
 - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 6. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or re-hang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather-tight condition.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01 73 29

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 1: GENERAL REQUIREMENTS
Section 01 74 23: Final Cleaning

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for final cleaning at Substantial Completion.
 - 1. Special cleaning requirements for specific elements of the Work are included in appropriate Sections of Divisions-2 through -16.
- B. General Project closeout requirements are included in Section "Project Closeout."
- C. General cleanup and waste removal requirements are included in Section "Temporary Facilities."
- D. Multiple Prime Contracts: Except as otherwise indicated, each prime Contractor is responsible for final cleaning his own Work. The Contractor for General Construction is responsible for coordination of final cleaning where more than one prime Contractor is involved in final cleaning a single area or piece of equipment.
- E. Environmental Requirements: Conduct cleaning and waste disposal operations in compliance with local laws and ordinances. Comply fully with federal and local environmental and anti-pollution regulations.
 - 1. Do not dispose of volatile wastes such as mineral spirits, oil or paint thinner in storm or sanitary drains.
 - 2. Burning or burying of debris, rubbish or other waste material on the premises will not be permitted.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by the manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property, or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Provide final cleaning operations when indicated. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of Work to the condition expected from a commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. Complete the following cleaning operations before requesting inspection for Certification of Final Completion for the entire Project or a portion of the Project.
1. Clean the Project site, yard and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste materials, litter and foreign substances. Sweep paved areas broom clean. Remove petro-chemical spills, stains and other foreign deposits. Rake grounds that are neither planted nor paved, to a smooth even-textured surface.
 2. Remove tools, construction equipment, machinery and surplus material from the site.
 3. Remove snow and ice to provide safe access to the building.
 4. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 5. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics and similar spaces.
 6. Broom clean concrete floors in unoccupied spaces.
 7. Vacuum clean carpet and similar soft surfaces, removing debris and excess nap. Shampoo if required.
 8. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 9. Remove labels that are not permanent labels.
 10. Touch-up and otherwise repair and restore marred exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored, or that show evidence of repair or restoration. Do not paint over "UL" and similar labels, including mechanical and electrical name plates.
 11. Wipe surfaces of mechanical and electrical equipment, elevator equipment and similar equipment. Remove excess lubrication, paint and mortar droppings and other foreign substances.
 12. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 13. Replace air disposable filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills. Clean ducts, blowers, and coils if units were operated without filters during construction.
 14. Clean food service equipment to a sanitary condition, ready and acceptable for its intended use.
 15. Clean light fixtures, lamps, globes and reflectors to function with full efficiency. Replace burned out bulbs, and defective and noisy starters in fluorescent and mercury vapor fixtures.
 16. Leave the Project clean and ready for occupancy.
- C. Removal of Protection: Remove temporary protection and facilities installed during construction to protect previously completed installations during the remainder of the construction period.
- D. Compliances: Comply with governing regulations and safety standards for cleaning operations. Remove waste materials from the site and dispose of in a lawful manner.
1. Where extra materials of value remain after completion of associated construction have become the Owner's property, dispose of these materials as directed.

END OF SECTION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 1: GENERAL REQUIREMENTS
Section 01 77 00: Project Closeout

1.1 GENERAL:

- A. Upon completion of the project, the contractor will be required to furnish the following items to the Architect before approval of final payment will be made.
- B. The General Contractor shall organize and schedule a Pre-Closeout Meeting to review procedure and process for closeout requirements.

1.2 ITEMS TO BE FURNISHED:

- A. Contractor's one-year warranty on all materials, equipment, and workmanship, as provided for in the General and Supplementary General Conditions.
- B. One-year warranties on materials, equipment and workmanship for plumbing, heating, air-conditioning and electrical equipment, or any other item furnished under this contract requiring maintenance at the building. These shall be furnished all at one time in neatly bound form.
- C. Complete Operating and maintenance instructions for all mechanical or electrical equipment, or any other item furnished under this contract requiring maintenance at the building. These shall be furnished all at one time in neatly bound form.
- D. Evidence that all indebtedness has been paid to subcontractors and material suppliers.
- E. Roofing and flashing guarantee.
- F. Advertisement for Completion.
- G. Termite Treatment Guarantee.
- H. One set of completed updated reproducible Record Drawings (Mylar) and Specifications. See Special Conditions of the Contract, Item 1, "Project and Record Documents".

END OF SECTION 01 77 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 1: GENERAL REQUIREMENTS
Section 01 78 23: Operating and Maintenance Data

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for operating and maintenance manuals including the following:
 - 1. Preparation and submittal of operating and maintenance manuals for building operating systems or equipment.
 - 2. Preparation and submittal of instruction manuals covering the care, preservation and maintenance of architectural products and finishes.
 - 3. Instruction of the Owner's operating personnel in operation and maintenance of building systems and equipment.
- B. Special operating and maintenance data requirements for specific pieces of equipment or building operating systems are included in the appropriate Sections of Divisions-2 through -16.
- C. Preparation of Shop Drawings and Product Data are included in Section "Submittals."
- D. General closeout requirements are included in Section "Project Closeout."
- E. General requirements for submittal of Project Record Documents are included in Section "Project Closeout."
- F. Multiple Prime Contracts: Each prime Contractor shall prepare operating and maintenance data for its own installations.
 - 1. Where operating and maintenance manuals include information on installations by the General Contractor for General Construction and another General Contractor, the General Contractor for General Construction shall prepare the manuals, including collection, collation and binding of the material and submittal of data as specified.
 - 2. Where operating and maintenance manuals include information on installations by more than one prime Contractor, other than the General Contractor for General Construction, the General Contractor who is the principal source of information, as determined by the Architect shall receive information furnished by other General Contractors, coordinate, collate, and bind the material into unified manuals, and submit the manuals, as specified.
 - 3. Where instruction in operating and maintenance procedures on equipment and systems involves participation of more than one General Contractor, the General Contractor who is designated by the Architect as the principal instructor shall coordinate with the other General Contractors for a mutually agreeable time to provide instruction to the Owner's operating and maintenance personnel.

1.3 QUALITY ASSURANCE

- A. Maintenance Manual Preparation: In preparation of Maintenance Manuals, use personnel

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

thoroughly trained and experienced in operation and maintenance of the equipment or system involved.

1. Where written instructions are required, use personnel skilled in technical writing to the extent necessary for communication of essential data.
 2. Where Drawings or diagrams are required, use draftsmen capable of preparing Drawings clearly in an understandable format.
- B. Instructions for the Owner's Personnel: For instruction of the Owner's operating and maintenance personnel, use experienced instructors thoroughly trained and experienced in the operation and maintenance of the building equipment or system involved.

1.4 SUBMITTALS

- A. Submittal Schedule: Comply with the following schedule for submittal of operating and maintenance manuals.
1. Before Substantial Completion, when each installation that requires submittal of operating and maintenance manuals is nominally complete, submit two draft copies of each manual to the Architect for review. Include a complete index or table of contents of each manual.
 - a. The Architect will return one copy of the draft with comments within fifteen days of receipt.
 2. Submit one copy of data in final form at least fifteen days before final inspection. This copy will be returned within fifteen days after final inspection, with comments.
 3. After final inspection make corrections or modifications to comply with the Architect's comments. Submit the specified number of copies of each approved manual to the Architect within fifteen days of receipt of the Architect's comments.
- B. Form of Submittal: Prepare operating and maintenance manuals in the form of an instructional manual for use by the Owner's operating personnel. Organize into suitable sets of manageable size. Where possible, assemble instructions for similar equipment into a single binder.
1. Binders: For each manual, provide heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, in thickness necessary to accommodate contents, sized to receive 8-1/2" by 11" paper. Provide a clear plastic sleeve on the spine, to hold labels describing the contents. Provide pockets in the covers to receive folded sheets.
 - a. Where two or more binders are necessary to accommodate data, correlate data in each binder into related groupings in accordance with the Project Manual table of contents. Cross-reference other binders where necessary to provide essential information for proper operation or maintenance of the piece of equipment or system.
 - b. Identify each binder on the front and spine, with the typed or printed title "OPERATION AND MAINTENANCE MANUAL", Project title or name, and subject matter covered. Indicate the volume number for multiple volume sets of manuals.
 2. Dividers: Provide heavy paper dividers with celluloid covered tabs for each separate Section. Mark each tab to indicate contents. Provide a typed description of the product and major parts of equipment included in the Section on each divider.
 3. Protective Plastic Jackets: Provide protective transparent plastic jackets designed to enclose diagnostic software for computerized electronic equipment.
 4. Text Material: Where written material is required as part of the manual use the

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

manufacturer's standard printed material, or if it is not available, specially prepared data, neatly typewritten, on 8-1/2" by 11", 20-pound white bond paper.

5. Drawings: Where drawings or diagrams are required as part of the manual, provide reinforced punched binder tabs on the drawings and bind in with the text.
 - a. Where oversize drawings are necessary, fold the drawings to the same size as the text pages and use as a fold-out.
 - b. If drawings are too large to be used practically as a fold-out, place the drawing, neatly folded, in the front or rear pocket of the binder. Insert a typewritten page indicating the drawing title, description of contents and drawing location at the appropriate location in the manual.

1.5 MANUAL CONTENT

- A. In each manual include information specified in the individual Specification Section, and the following information for each major component of building equipment and its controls:
 1. General system or equipment description.
 2. Design factors and assumptions.
 3. Copies of applicable Shop Drawings and Product Data.
 4. System or equipment identification, including:
 - a. Name of manufacturer.
 - b. Model number.
 - c. Serial number of each component.
 5. Operating instructions.
 6. Emergency instructions.
 7. Wiring diagrams.
 8. Inspection and test procedures.
 9. Maintenance procedures and schedules.
 10. Precautions against improper use and maintenance.
 11. Copies of warranties.
 12. Repair instructions including spare parts listing.
 13. Sources of required maintenance materials and related services.
 14. Manual Index.
- B. Organize each manual into separate Sections for each piece of related equipment. As a minimum each manual shall contain a title page, a table of contents, copies of Product Data, supplemented by drawings and written text, and copies of each warranty, bond and service Contract issued.
 1. Title Page: Provide a title page in a transparent plastic envelope as the first sheet of each manual. Provide the following information:
 - a. Subject matter covered by the manual.
 - b. Name and address of the Project.
 - c. Date of submittal.
 - d. Name, address, and telephone number of the Contractor.
 - e. Name and address of the Architect.
 - f. Cross reference to related systems in other operating and maintenance manuals.
 2. Table of Contents: After the Title Page, include a typewritten table of contents for each volume, arranged systematically according to the Project Manual format. Include a list of each product included, identified by product name or other appropriate identifying symbol

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

and indexed to the content of the volume.

- a. Where more than one volume is required to accommodate data for a particular system, provide a comprehensive table of contents for all volumes in each volume of the set.
3. General Information: Provide a general information Section immediately following the Table of Contents, listing each product included in the manual, identified by product name. Under each product, list the name, address, and telephone number of the Subcontractor or installer, and the maintenance contractor. Clearly delineate the extent of responsibility of each of these entities. In addition, list a local source for replacement parts and equipment.
4. Product Data: Where manufacturer's standard printed data is included in the manuals, include only sheets that are pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation. Where more than one item in a tabular format is included, identify each item, using appropriate references from the Contract Documents. Identify data that is applicable to the installation and delete references to information that is not applicable.
5. Written Text: Where manufacturer's standard printed data is not available, and information is necessary for proper operation and maintenance of equipment or systems, or it is necessary to provide additional information to supplement data included in the manual, prepare written text to provide necessary information. Organize the text in a consistent format under separate headings for different procedures. Where necessary, provide a logical sequence of instruction for each operating or maintenance procedure.
6. Drawings: Provide specially prepared drawings where necessary to supplement manufacturer's printed data to illustrate the relationship of component parts of equipment or systems, or to provide control or flow diagrams. Coordinate these drawings with information contained in Project Record Drawings to assure correct illustration of the completed installation.
7. Do not use original Project Record Documents as part of the Operating and Maintenance Manuals.
8. Warranties, Bonds and Service Contracts: Provide a copy of each warranty, bond or service contract in the appropriate manual for the information of the Owner's operating personnel. Provide written data outlining procedures to be followed in the event of product failure. List circumstances and conditions that would affect validity of the warranty or bond.

1.6 MATERIAL AND FINISHES MAINTENANCE MANUAL

- A. Submit three copies of each manual, in final form, on material and finishes to the Architect for distribution. Provide one section for architectural products, including applied materials and finishes, and a second for products designed for moisture- protection and products exposed to the weather.
 1. Refer to individual Specification Sections for additional requirements on care and maintenance of materials and finishes.
- B. Architectural Products: Provide manufacturer's data and instructions on care and maintenance of architectural products, including applied materials and finishes.
 1. Manufacturer's Data: Provide complete information on architectural products, including the following, as applicable:
 - a. Manufacturer's catalog number.
 - b. Size.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- c. Material composition.
 - d. Color.
 - e. Texture.
 - f. Reordering information for specially manufactured products.
2. Care and Maintenance Instructions: Provide information on care and maintenance, including manufacturer's recommendations for types of cleaning agents to be used and methods of cleaning. Provide information regarding cleaning agents and methods that could prove detrimental to the product. Include manufacturer's recommended schedule for cleaning and maintenance.
- C. Moisture-Protection and Weather-Exposed Products: Provide complete manufacturer's data with instructions on inspection, maintenance and repair of products exposed to the weather or designed for moisture-protection purposes.
1. Manufacturer's Data: Provide manufacturer's data giving detailed information, including the following, as applicable:
 - a. Applicable standards.
 - b. Chemical composition.
 - c. Installation details.
 - d. Inspection procedures.
 - e. Maintenance information.
 - f. Repair procedures.

1.7 EQUIPMENT AND SYSTEMS MAINTENANCE MANUAL

- A. Submit six copies of each completed manual on equipment and systems, in final form, to the Architect for distribution. Provide separate manuals for each unit of equipment, each operating system, and each electric and electronic system.
1. Refer to Specification Sections for additional requirements on operating and maintenance of the various pieces of equipment and operating systems.
- B. Equipment and Systems: Provide the following information for each piece of equipment, each building operating system, and each electric or electronic system.
1. Description: Provide a complete description of each unit and related component parts, including the following:
 - a. Equipment or system function.
 - b. Operating characteristics.
 - c. Limiting conditions.
 - d. Performance curves.
 - e. Engineering data and tests.
 - f. Complete nomenclature and number of replacement parts.
 2. Manufacturer's Information: For each manufacturer of a component part or piece of equipment provide the following:
 - a. Printed operating and maintenance instructions.
 - b. Assembly drawings and diagrams required for maintenance.
 - c. List of items recommended to be stocked as spare parts.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Maintenance Procedures: Provide information detailing essential maintenance procedures, including the following:
 - a. Routine operations.
 - b. Trouble-shooting guide.
 - c. Disassembly, repair, and reassembly.
 - d. Alignment, adjusting and checking.
4. Operating Procedures: Provide information on equipment and system operating procedures, including the following:
 - a. Start-up procedures.
 - b. Equipment or system break-in.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Instructions on stopping.
 - f. Shut-down and emergency instructions.
 - g. Summer and winter operating instructions.
 - h. Required sequences for electric or electronic systems.
 - i. Special operating Instructions.
5. Servicing Schedule: Provide a schedule of routine servicing and lubrication requirements, including a list of required lubricants for equipment with moving parts.
6. Controls: Provide a description of the sequence of operation and as-installed control diagrams by the control manufacturer for systems requiring controls.
7. Coordination Drawings: Provide each Contractor's Coordination Drawings.
 - a. Provide as-installed color-coded piping diagrams, where required for identification.
8. Valve Tags: Provide charts of valve tag numbers, with the location and function of each valve.
9. Circuit Directories: For electric and electronic systems, provide complete circuit directories of panelboards, including the following:
 - a. Electric service.
 - b. Controls.
 - c. Communication.

1.8 INSTRUCTIONS OF THE OWNER'S PERSONNEL

- A. Prior to final inspection, instruct the Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Provide instruction at mutually agreed upon times.
 1. For equipment that requires seasonal operation, provide similar instruction during other seasons.
 2. Use operation and maintenance manuals for each piece of equipment or system as the basis of instruction. Review contents in detail to explain all aspects of operation and maintenance.
 3. Make a video of training and provide two (2) DVDs of each training session.

PART 2 - PRODUCTS (Not Applicable)
PART 3 - EXECUTION (Not Applicable)
END OF SECTION 01 78 23

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 1: GENERAL REQUIREMENTS
Section 01 78 29: Field Engineering

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section.

1.2 SUMMARY

- A. General: This Section specifies administrative and procedural requirements for field engineering services, including, but not necessarily limited to, the following:
 - 1. Land survey Work.
 - 2. Civil engineering services.
 - 3. Structural engineering services.
 - 4. Existing conditions dimension verification.

1.3 SUBMITTALS

- A. Certificates: Submit a certificate signed by the Land Surveyor or Professional Engineer certifying that the location and elevation of improvements comply with the Contract Documents.
- B. Final Property Survey: Submit 10 copies of the final property survey.
- C. Project Record Documents: Submit a record of Work performed and record survey data as required under provisions of Sections "Submittals" and "Project Closeout".

1.4 QUALITY ASSURANCE

- A. Surveyor: Engage a Registered Land Surveyor registered in the State where the project is located, to perform land surveying services required.
- B. Engineer: Engage a Professional Engineer of the discipline required, registered in the state in which the Project is located, to perform required engineering services.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. The Owner will identify existing control points and property line corner stakes.
- B. Verify existing and new layout information shown on the Drawings, in relation to the property survey and existing benchmarks before proceeding to layout the Work. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Do not change or relocate benchmarks or control points without prior written approval. Promptly report lost or destroyed reference points, or requirements to relocate reference points because of necessary changes in grades or locations.
 2. Promptly replace lost or destroyed project control points. Base replacements on the original survey control points.
- C. Establish and maintain a minimum of two permanent benchmarks on the site, referenced to data established by survey control points.
1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
- D. Existing utilities and equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction.
1. Prior to construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer and water service piping.

3.2 PERFORMANCE

- A. Working from lines and levels established by the property survey, establish benchmarks and markers to set lines and levels at each story of construction and elsewhere as needed to properly locate each element of the Project. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale Drawings to determine dimensions.
1. Advise entities engaged in construction activities, of marked lines and levels provided for their use.
 2. As construction proceeds, check every major element for line, level and plumb.
- B. Surveyor's Log: Maintain a surveyor's log of control and other survey Work. Make this log available for reference.
1. Record deviations from required lines and levels and advise the Architect when deviations that exceed indicated or recognized tolerances are detected. On Project Record Drawings, record deviations that are accepted and not corrected.
 2. On completion of foundation walls, major site improvements, and other Work requiring field engineering services, prepare a certified survey showing dimensions, locations, angles and elevations of construction and sitework.
- C. Site Improvements: Locate and lay out site improvements, including pavements, stakes for grading, fill and topsoil placement, utility slopes and invert elevations by instrumentation and similar appropriate means.
- D. Building Lines and Levels: Locate and lay out batter boards for structures, building foundations, column grids and locations, floor levels and control lines and levels required for mechanical and electrical Work.
- E. Existing Utilities: Furnish information necessary to adjust, move or relocate existing structures, utility poles, lines, services, or other appurtenances located in, or affected by construction. Coordinate with local authorities having jurisdiction.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- F. Final Property Survey: Before Substantial Completion, prepare a final property survey showing significant features (real property) for the Project. Include on the survey a certification, signed by the Surveyor, to the effect that principal metes, bounds, lines, and levels of the Project are accurately positioned as shown on the survey.
 - 1. Recording: At Substantial Completion, have the final property survey recorded by or with local governing authorities as the official "property survey".

END OF SECTION 01 78 29

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 1: GENERAL REQUIREMENTS
Section 01 78 36: Warranties and Bonds

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties.
 - 1. Refer to the General Conditions for terms of the Contractor's special warranty of workmanship and materials.
 - 2. General closeout requirements are included in Section "Project Closeout."
 - 3. Specific requirements for warranties for the Work and products and installations that are specified to be warranted, are included in the individual Sections of Divisions-2 through -16.
 - 4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.
- B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.
- C. Separate Prime Contracts: Each prime Contractor is responsible for warranties related to its own Contract.

1.3 DEFINITIONS

- A. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.4 WARRANTY REQUIREMENTS

- A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
- B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

- D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
 - 1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- E. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.5 SUBMITTALS

- A. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.
 - 1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect within fifteen days of completion of that designated portion of the Work extending the time to coincide with the date of overall Substantial Completion.
- B. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Architect for approval prior to final execution.
- C. Forms for special warranties are included at the end of this Section. Prepare a written document utilizing the appropriate form, ready for execution by the Contractor, or the Contractor and subcontractor, supplier or manufacturer. Submit a draft to the Owner through the Architect for approval prior to final execution.
 - 1. Refer to individual Sections of Divisions-2 through -16 for specific content requirements, and particular requirements for submittal of special warranties.
- D. Form of Submittal: At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- E. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.
2. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS, the Project title or name, and the name of the Contractor.
3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION

3.1 SCHEDULE OF WARRANTIES

- A. Schedule: Provide warranties and bonds on products and installations as specified herein and as required.

END OF SECTION 01 78 36

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 1: GENERAL REQUIREMENTS
Section 01 78 39: Project Record Documents

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for Project Record Documents.
- B. Project Record Documents required include:
 - 1. Marked-up copies of Contract Drawings.
 - 2. Marked-up copies of Shop Drawings.
 - 3. Newly prepared Drawings.
 - 4. Marked-up copies of Specifications, addenda and Change Orders.
 - 5. Marked-up Product Data submittals.
 - 6. Record Samples.
 - 7. Field records for variable and concealed conditions.
 - 8. Record information on Work that is recorded only schematically.
- C. Specific record copy requirements that expand requirements of this Section are included in the individual Sections of Divisions-2 through -16.
- D. General project closeout requirements are included in Section "Project Closeout."
- E. General requirements for submittal of Project Record Documents are included in Section "Submittals."
- F. Multiple Prime Contracts: Each prime Contractor is responsible for obtaining, maintaining, and recording Project Record Document information for its own part of the Work. The Contractor for General Construction is responsible for coordination of Project Record Document information, where information from more than one prime Contractor is indicated to be integrated to form one combined record of the Work.
- G. Maintenance of Documents and Samples: Store record documents and Samples in the field office apart from Contract Documents used for construction. Do not permit Project Record Documents to be used for construction purposes. Maintain record documents in good order, and in a clean, dry, legible condition. Make documents and Samples available at all times for inspection by the Architect.

1.3 RECORD DRAWINGS

- A. Mark-up Procedure: During the construction period, maintain a set of blue- or black-line white-prints of Contract Drawings and Shop Drawings for Project Record Document purposes.
 - 1. Mark these Drawings to indicate the actual installation where the installation varies appreciably from the installation shown originally. Give particular attention to information on concealed elements which would be difficult to identify or measure and record later.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

Items required to be marked include but are not limited to:

- a. Dimensional changes to the Drawings.
 - b. Revisions to details shown on the Drawings.
 - c. Depths of foundations below the first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order.
 - k. Details not on original Contract Drawings.
2. Mark completely and accurately record prints of Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions. Where Shop Drawings are marked, show cross-reference on Contract Drawings location.
 3. Mark record sets with red erasable colored pencil; use other colors to distinguish between changes for different categories of the Work at the same location.
 4. Mark important additional information which was either shown schematically or omitted from original Drawings.
 5. Note construction change directive numbers, alternate numbers, Change Order numbers and similar identification.
 6. Responsibility for Markup: Where feasible, the individual or entity who obtained record data, whether the individual or entity is the installer, subcontractor, or similar entity, is required to prepare the mark-up on record Drawings.
 - a. Accurately record information in an understandable Drawing technique.
 - b. Record data as soon as possible after it has been obtained. In the case of concealed installations, record and check the mark-up prior to concealment.
 7. At time of Final Completion, submit record Drawings to Architect for Owner's records. Organize into sets, bind and label sets for Owner's continued use.
- B. Preparation of Transparencies: Immediately prior to inspection for Certification of Final Completion, review completed marked-up record Drawings with the Architect. When authorized, prepare a full set of corrected transparencies of Contract Drawings and Shop Drawings.
1. Incorporate changes and additional information previously marked on print sets. Erase, redraw, and add details and notations where applicable. Identify and date each Drawing; include the printed designation "PROJECT RECORD DRAWINGS" in a prominent location on each Drawing.
 2. Refer instances of uncertainty to the Architect for resolution.
 3. One set of transparencies of original Contract Drawings will be furnished to the Contractor by the Owner for use in recording changes and additional information. Other printing as required is the Contractor's responsibility.
 4. The Contractor is responsible for printing original Contract Drawings and other Drawings as required to produce transparencies. The Architect will make original Contract Drawings available to the Contractor's print shop.
 5. In cases where installations by two or more prime Contractors are indicated on the same Drawing, the Contractor responsible for the principal installation, as determined by the Architect, is responsible for printing and distributing transparencies.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. The Contractor for General Construction is responsible for printing and distributing transparencies where the Drawing covers installations of other prime Contractors as well as that of the Contractor for General Construction.
6. Review of Transparencies: Before copying and distributing, submit corrected transparencies and the original marked-up prints to the Architect for review. When acceptable, the Architect will initial and date each transparency, indicating acceptance of general scope of changes and additional information recorded, and of the quality of drafting.
 - a. Transparencies and the original marked-up prints will be returned to Contractor for organizing into sets, printing, binding and final submittal.
- C. Copies and Distribution: After completing the preparation of transparency record drawings, print 3 blue-line or black-line prints of each Drawing, whether or not changes and additional information were recorded. Organize the copies into manageable sets. Bind each set with durable paper cover sheets, with appropriate identification, including titles, dates and other information on cover sheets.
 1. Organize and bind original marked-up set of prints that were maintained during the construction period in the same manner.
 2. Organize record transparencies into sets matching the print sets. Place these sets in durable tube-type Drawing containers with end caps. Mark the end cap of each container with suitable identification.
 3. Submit the marked-up record set, transparencies, and 3 copy sets to the Architect for Owner's records; the Architect will retain one copy set.
- D. Newly Prepared Record Drawings: Prepare new Drawings instead of following procedures specified for preparation of record Drawings where new Drawings are required by a Change Order issued as a result of acceptance of an alternate, substitution, or other modification, and the Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show the actual installation.
 1. Consult with the Architect for the proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. When completed and accepted, integrate newly prepared Drawings with procedures specified for organizing, copying, binding and submittal of record Drawings.
 2. Each prime Contractor has same responsibility for newly prepared record Drawings as specified for mark-up of prints and preparation of transparencies.

1.4 RECORD SPECIFICATIONS

- A. During the construction period, maintain one copy of the Project Specifications, including addenda and modifications issued, for Project Record Document purposes.
 1. Mark the Specifications to indicate the actual installation where the installation varies substantially from that indicated in Specifications and modifications issued. Note related Project Record Drawing information, where applicable. Give particular attention to substitutions, selection of product options, and information on concealed installations that would be difficult to identify or measure and record later.
 - a. In each Specification Section where products, materials or units of equipment are specified or scheduled, mark the copy with the proprietary name and model number of the product furnished.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- b. Record the name of the manufacturer, supplier and installer, and other information necessary to provide a record of selections made and to document coordination with record Product Data submittals and maintenance manuals.
 - c. Note related record Product Data, where applicable. For each principal product specified, indicate whether record Product Data has been submitted in maintenance manual instead of submitted as record Product Data.
 2. Upon completion of mark-up, submit record Specifications to the Architect for Owner's records.
 3. Each prime Contractor is responsible for marking-up Sections that contain its own Work.
 - a. The Contractor for General Construction is responsible for collecting marked-up record Sections from each of the other prime Contractors, and for collating these Sections in proper numeric order with its own Sections to form a complete set of record Specifications.
 - b. The Contractor for General Construction is responsible for submitting the complete set of record Specifications as specified.

1.5 RECORD PRODUCT DATA

- A. During the construction period, maintain one copy of each Product Data submittal for Project Record Document purposes.
 1. Mark Product Data to indicate the actual product installation where the installation varies substantially from that indicated in Product Data submitted. Include significant changes in the product delivered to the site, and changes in manufacturer's instructions and recommendations for installation.
 2. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 3. Note related Change Orders and mark-up of record Drawings, where applicable.
 4. Upon completion of mark-up, submit a complete set of record Product Data to the Architect for the Owner's records.
 5. Where record Product Data is required as part of maintenance manuals, submit marked-up Product Data as an insert in the manual, instead of submittal as record Product Data.
 6. Each prime Contractor is responsible for mark-up and submittal
 7. of record Product Data for its own Work.

1.6 RECORD SAMPLE SUBMITTAL

- A. Immediately prior to date of Final Completion, the Contractor shall meet with the Architect and, if desired, the Owner's personnel at the site to determine which of the Samples maintained during the construction period shall be transmitted to Owner for record purposes. Comply with the Architect's instructions for packaging, identification marking, and delivery to Owner's Sample storage space. Dispose of other Samples in manner specified for disposal of surplus and waste materials.

1.7 MAINTENANCE MANUAL SUBMITTAL

- A. When each construction activity that requires submittal of maintenance manuals is nominally complete, but before Final Completion, submit maintenance manuals specified.
 1. Organize operating and maintenance manuals into suitable sets of manageable size.
 2. Bind data into individual binders for each manual, properly identified on front and spine.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- For large manuals, provide an index sheet and thumb tabs for separate information categories.
3. Provide heavy-duty 3-ring vinyl-covered binders, 1" to 2" thick as required to contain information, sized for 8-1/2" x 11" paper with inside pockets or pocket folders for folded sheets.
 4. In each maintenance manual include information specified in individual Specification Sections and the following:
 - a. Emergency instructions.
 - b. Spare parts list.
 - c. Copies of specific warranties.
 - d. Wiring diagrams.
 - e. Recommended maintenance procedures and turn-around times.
 - f. Inspection and system-test procedures.
 - g. Copies of applicable Shop Drawings and Product Data.
 - h. Listing of required maintenance materials and services.
 - i. Names and addresses of sources of maintenance materials.
 - j. Maintenance Drawings and diagrams.
 - k. Precautions against improper maintenance and exposure.
 5. Each prime Contractor is responsible for maintenance manuals for its own Work. Where a manual includes information on installations by more than one Contract, the Contractor who is principal source of information, as designated by Architect, shall receive information from other Contractors, coordinate and collate information for a unified manual, and provide binders and submittal as specified.

1.8 MISCELLANEOUS RECORD SUBMITTALS

- A. Refer to other Specification Sections for miscellaneous record- keeping requirements and submittals in connection with various construction activities. Immediately prior to Final Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for use and reference. Submit to the Architect for the Owner's records.
 1. Categories of requirements resulting in miscellaneous records include, but are not limited to the following:
 - a. Field records on excavations and foundations.
 - b. Field records on underground construction and similar Work.
 - c. Survey showing locations and elevations of underground lines.
 - d. Invert elevations of drainage piping.
 - e. Surveys establishing building lines and levels.
 - f. Authorized measurements utilizing unit prices or allowances.
 - g. Records of plant treatment.
 - h. Ambient and substrate condition tests.
 - i. Certifications received in lieu of labels on bulk products.
 - j. Batch mixing and bulk delivery records.
 - k. Testing and qualification of tradesmen.
 - l. Documented qualification of installation firms.
 - m. Load and performance testing.
 - n. Inspections and certifications by governing authorities.
 - o. Leakage and water-penetration tests.
 - p. Fire resistance and flame spread test results.
 - q. Final inspection and correction procedures.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

PART 2 - PRODUCTS (not applicable)

PART 3 - EXECUTION

3.1 RECORDING

- A. Post changes and modifications to the Documents as they occur. Do not wait until the end of the Project. The Architect will periodically review record documents to assure compliance with this requirement.

END OF SECTION 01 78 39

CALHOUN COUNTY JAIL
ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 02 00 00: EXISTING CONDITIONS
Section 02 32 13: Geotechnical Investigations

1.1 GENERAL

- A. The following geotechnical report is dated August 2, 2023 by Building and Earth, 5545 Derby Drive, Birmingham, AL 35210; (205) 836-6300
- B. The reports are included for the Contractor's convenience. The Owner and Architect assume no responsibility for the accuracy or completeness nor for any conclusions which may be drawn from the investigation.
- C. The Contractor shall follow the recommendations made unless specifically noted otherwise on the drawings. Should conflict occur between specification wording and geotechnical recommendation intent, the geotechnical recommendation shall govern.

END OF SECTION 02 32 13



REPORT OF SUBSURFACE EXPLORATION
AND GEOTECHNICAL EVALUATION
CALHOUN COUNTY JAIL EXPANSION
ANNISTON, AL
BUILDING & EARTH PROJECT No.: BH230206

PREPARED FOR:
Calhoun County Commission

AUGUST 2, 2023



August 2, 2023

Calhoun County Commission
1702 Noble Street, Suite 103
Anniston, AL 36201

Attention: Ms. Anna Harris (anna@jayjenkinsarchitecture.com)

Subject: Report of Subsurface Exploration and Geotechnical Evaluation
Calhoun County Jail Expansion
Anniston, Alabama
Building & Earth Project No.: BH230206

Dear Ms. Harris:

Building & Earth Sciences, Inc. has completed the authorized subsurface exploration and geotechnical engineering evaluation for the Calhoun County Jail Expansion in Anniston, Alabama.

The purpose of this exploration and evaluation was to assess general subsurface conditions at the site and to address applicable geotechnical aspects of the proposed construction and site development. The recommendations in this report are based on a physical reconnaissance of the site and observation and classification of samples obtained from five (5) soil test borings conducted at the site. Confirmation of the anticipated subsurface conditions during construction is an essential part of geotechnical services.

We appreciate the opportunity to provide consultation services for the proposed project. If you have any questions regarding the information in this report or need any additional information, please call us.

Respectfully Submitted,
BUILDING & EARTH SCIENCES, INC.



Rodney Collins, Ph.D., P.E.
Project Engineer



Jacob Short, P.E.
Senior Geotechnical Engineer



Table of Contents

1.0 PROJECT & SITE DESCRIPTION.....	1
2.0 SCOPE OF SERVICES	3
3.0 GEOTECHNICAL SITE CHARACTERIZATION.....	5
3.1 GEOLOGY	5
3.2 EXISTING SURFACE CONDITIONS	5
3.3 SUBSURFACE CONDITIONS	6
3.3.1 EXISTING FILL.....	6
3.3.2 RESIDUAL SOIL	7
3.3.3 WEATHERED DOLOMITE	7
3.3.4 GROUNDWATER.....	7
4.0 SITE DEVELOPMENT CONSIDERATIONS.....	7
4.1 INITIAL SITE PREPARATION	8
4.2 SUBGRADE EVALUATION	9
4.3 MOISTURE SENSITIVE SOILS	9
4.4 STRUCTURAL FILL	9
4.5 EXCAVATION CONSIDERATIONS.....	11
4.5.1 GROUNDWATER.....	11
4.6 LANDSCAPING AND DRAINAGE CONSIDERATION.....	11
4.7 WET WEATHER CONSTRUCTION.....	11
5.0 FOUNDATION RECOMMENDATIONS.....	12
6.0 FLOOR SLABS	12
7.0 SUBGRADE REHABILITATION	13
8.0 CONSTRUCTION MONITORING.....	14
9.0 CLOSING AND LIMITATIONS.....	14

APPENDIX

1.0 PROJECT & SITE DESCRIPTION

Proposed for development is a new addition to the existing Calhoun County Jail. It is understood that the new structure will comprise of two-level precast concrete modules and grout filled load bearing masonry walls on 2-foot-wide footings. The second level will be poured-in-place concrete on load bearing masonry. The subject site is located at 400 W 8th St. in Anniston, AL. Information relative to the proposed site and the proposed development is listed in Table 1 below. Photographs depicting the current site condition are presented on the following page.

Development Item	Detail	Description
General Site	Size (Ac.)	Not Provided
	Existing Development	Calhoun County Jail
	Vegetation	Short grass
	Slopes	The site was relatively flat
	Retaining Walls	None
	Drainage	Fair
	Cuts & Fills	Less than 3 feet (assumed)
Proposed Buildings	No. of Bldgs	1
	Square Ft.	On the order of 2,500 sf (assumed)
	Stories	2
	Construction	Precast concrete and masonry
	Column Loads	Less than 150 kips
	Wall Loads	Less than 5 kips per linear foot (assumed)
	Preferred Foundation	Aggregate Piers or Micropiles
	Preferred Slab	Concrete slab-on-grade

Table 1: Project and Site Description

Reference: RFP prepared by Jay Jenkins Architecture, undated. Structural loading information was based on communication with Karen Wright with LBYD.

Notes:

- 1. If actual loading conditions exceed our anticipated loads, Building & Earth Sciences should be allowed to review the proposed structural design and its effects on our recommendations for foundation design.***
- 2. When a grading plan is finalized, Building & Earth should be allowed to review the plan and its effects on our recommendations.***



Figure 1: Typical conditions near B-01 facing north



Figure 2: Typical conditions near B-02 facing south



Figure 3: Typical conditions near B-05 facing southwest

2.0 SCOPE OF SERVICES

The authorized subsurface exploration was performed on July 18, 2023, in conformance with our proposal BH25157 R1, dated July 11, 2023. Notice to proceed was provided from Jay Jenkins Architecture on July 11, 2023. Occasionally some modification of the scope outlined in our proposal is required to provide for proper evaluation of the encountered subsurface conditions. Two borings, B-01 and B-02, were extended beyond the planned bearing depths due to the presence of existing fill and soft/loose soils.

The purpose of the geotechnical exploration was to assess general subsurface conditions at specific boring locations and to gather data on which to base a geotechnical evaluation with respect to the proposed construction. The subsurface exploration for this project consisted of five (5) soil test borings. Refer to the APPENDIX for a description of the drilling and sampling procedures. The site was drilled using a Geoprobe 7822DT equipped with an automatic hammer for performing Standard Penetration Tests (SPT) to help evaluate the relative soil strength.

The soil boring locations were determined in the field by a representative of our staff using existing site features. As such, the boring locations shown on the Boring Location Plan attached to this report should be considered approximate.

The soil samples recovered during our site investigation were visually classified and specific samples were selected by the project engineer for laboratory analysis. The laboratory analysis consisted of:

Test	ASTM	No. of Tests
Natural Moisture Content	D2216	16
Atterberg Limits	D4318	2
Material Finer Than No. 200 Sieve by Washing	D1140	2

Table 2: Scope of Laboratory Tests

The results of the laboratory analysis are presented on the enclosed Boring Logs and in tabular form in the Appendix of this report. Descriptions of the laboratory tests that were performed are also included in the APPENDIX.

The information gathered from the exploration was evaluated to determine a suitable foundation type for the proposed structure. The information was also evaluated to help determine if any special subgrade preparation procedures will be required during the earthwork phase of the project.

The results of the work are presented within this report that addresses:

- Site geology and potential impact on the site development.
- Summary of existing surface conditions.
- A description of the subsurface conditions encountered at the soil test boring locations including a description of the groundwater conditions observed in the boreholes during drilling. Long-term groundwater monitoring was not included in our scope of work.
- Presentation of laboratory test results.
- Site preparation considerations including material types to be expected at the site and treatment of unsuitable soils, if encountered.
- Compaction requirements and recommended criteria to establish suitable material for structural backfill.

- Recommendations to be used for foundation design, including appropriate foundation types, bearing pressures, and depths.

3.0 GEOTECHNICAL SITE CHARACTERIZATION

The following discussion is intended to create a general understanding of the site from a geotechnical engineering perspective. It is not intended to be a discussion of every potential geotechnical issue that may arise, nor to provide every possible interpretation of the conditions identified. The following conditions and subsequent recommendations are based on the assumption that significant changes in subsurface conditions do not occur between boreholes. However, anomalous conditions can occur due to variations in existing fill that may be present at the site or the geologic conditions at the site. It will be necessary to evaluate the assumed conditions during site grading and foundation installation.

3.1 GEOLOGY

The City of Anniston is situated in the Alabama Valley and Ridge Physiographic Province. The Geologic Map of Alabama on the Alabama Data Portal published by the Geologic Survey of Alabama indicates that the subject site is underlain by the Shady Dolomite of Cambrian Age. The formation consists of bluish-gray or pale-yellowish-gray, thick bedded siliceous dolomite. The Shady Dolomite is characterized by coarsely crystalline, porous chert. Dolomite bedrock typically weathers to a clayey soil that may be as much as 100 feet thick. The residual soil formed from the natural physical and chemical weathering of the bedrock can contain fragments and boulders of dolomite, as well as varying concentrations of chert fragments. The soils developed from dolomite formations have been observed to have a moderate to high shrink-swell potential.

Dolomite formations are prone to the development of sinkholes. Although the site is prone to the development of sinkholes, there is no certainty that a sinkhole or other sinkhole related features will or will not develop in the future. The owner should acknowledge that there is some risk (of ground subsidence) associated with building over geologic formations that are prone to the formation of sinkholes.

3.2 EXISTING SURFACE CONDITIONS

At the time of our field exploration, the surface of the subject site was covered with short grass. A fence was present on the western side of the proposed addition area and was inaccessible to our drilling equipment. The site was relatively level. The existing structure was located west of the planned addition area. No cracking or signs of distress were observed on the outside of the existing structure.

Approximately 1 to 2 inches of topsoil were encountered at the surface in borings. The topsoil thickness is only accurate at the specific boring locations but can be extrapolated between boreholes for initial cost estimating purposes. The topsoil depths reported on the boring logs should only be construed as an estimate and actual conditions during construction will vary. The topsoil may be thicker in unexplored areas of the site, which can affect the quantity of topsoil removed during construction.

3.3 SUBSURFACE CONDITIONS

A generalized stratification summary has been prepared using data from the soil test borings and is presented in the table below. The stratification depicts the general soil conditions and strata types encountered during our field investigation.

Stratum No.	Description	Consistency
1	Topsoil (all borings)	N/A
2	Existing Fill – Sandy Lean Clay (CL), Silty Sand (SM) and Clayey Sand (SC)	Cohesive soils – medium stiff to very stiff Cohesionless – very loose to dense
3	Residual Soil – Fat Clay (CH)	Soft to stiff
4	Weathered Dolomite (B-01 only)	Hard

Table 3: Stratification Summary

A subsurface soil profile has also been prepared based on the data obtained at the specific boring locations. The subsurface soil profile is presented in the APPENDIX. For specific details on the information obtained from individual soil borings, please refer to the Boring Logs included in the APPENDIX. The elevations of the borings indicated in this report were estimated based on Google Earth and should be considered approximate.

3.3.1 EXISTING FILL

Previously placed fill material was identified immediately beneath the topsoil layer in all borings. The existing fill material extended to depths of about to 18.5 feet below the ground surface. The existing fill material consisted of lean clay (CL), silty sand (SM), and clayey sand (SC) soils. Low relative density ($N\text{-Value} \leq 8$) and low consistency ($N\text{-Value} \leq 6$) Standard Penetration Test (SPT) N-values were generally encountered below a depth of 3 feet. Based on the conditions encountered at the boring locations, the fill appears to be inconsistent and placed in an uncontrolled manner.

Moisture contents of the fill soil samples tested ranged from approximately 9 to 23 percent. Atterberg Limits tests performed on selected fill soil samples indicated low to moderate plasticity with Liquid Limits (LL) ranging from non-plastic to 36 and Plasticity

Indices (PI) ranging from non-plastic to 15. Wash No. 200 sieve tests performed on the selected fill samples indicated the samples contained approximately 14 to 65 percent fines.

3.3.2 RESIDUAL SOIL

Residual soils, materials formed by the in-place weathering of the parent bedrock, were encountered in all borings below the upper fill layer. The residual soils consisted of fat clay (CH) soils. The CH soils were typically stiff; however, low consistency (N-Value ≤ 6) soils were encountered in boring B-01 between depths of 6 to 28.5 feet below existing grade.

Moisture contents of the residual soil samples tested ranged from approximately 18 to 37 percent.

3.3.3 WEATHERED DOLOMITE

Weathered rock is formed by the natural in-place physical and chemical weathering of the parent bedrock formation. Weathered rock is typically considered a transition zone from residual soil to hard bedrock. During SPT sampling, the weathered rock is pulverized by the sampling equipment to the degree that it is retrieved as soil. Weathered rock is typically distinguished from residual soil when the SPT N-value is in excess of 50.

Weathered dolomite was encountered beneath the residual soils in borings B-01 at a depth of 28.5 feet below existing subgrade. The weathered dolomite extended to a boring termination depth of 30 feet. The weathered dolomite was sampled as very dense silty sand (SM) and was generally dark gray in color.

3.3.4 GROUNDWATER

At the time of drilling, groundwater was encountered in boring B-01 at a depth of 18.5 feet below existing grade. Water levels reported are accurate only for the time and date that the borings were drilled. Long term monitoring of the boreholes was not included as part of our subsurface exploration. The borings were backfilled the same day that they were drilled.

4.0 SITE DEVELOPMENT CONSIDERATIONS

A grading plan was not available at the time of this report. Based on existing site topography, we anticipate less than 3 feet of cut and fill will be required to reach finished grades. ***When the grading plan is finalized, Building & Earth should be allowed to review the plan and its effects on our recommendations.***

Based on our evaluation of the subsurface soil information, and the anticipated foundation loads, it appears that construction with a conventional shallow foundation system resting on an aggregate pier system is feasible. The site development recommendations outlined below are intended for development of the site to support construction with this foundation system. ***If a different type of foundation system is preferred, Building & Earth should be allowed to review the site development recommendations to verify that they are appropriate for the preferred foundation system.***

Settlement is anticipated to be on the order of 1 inch using an aggregate pier system. A micropile foundation system can be considered to reduce settlement, if needed. However, rock coring will be required to provide rock parameters.

The primary geotechnical concerns for this project are:

- The presence of uncontrolled fill across the site.
- The presence of low relative density (N-Value ≤ 8) and low consistency (N-Value ≤ 6) fill soils, mostly below a depth of 3 feet below existing grades.
- The presence of low consistency (N-Value ≤ 6) residual soils at depths below 6 feet from existing grade in boring B-01.
- The presence of moisture sensitive soils throughout the site.

Recommendations addressing the site conditions are presented in the following sections.

4.1 INITIAL SITE PREPARATION

All topsoil and deleterious materials should be removed from the proposed construction areas. Approximately 1 to 2 inches of topsoil were observed in all borings. A geotechnical engineer should observe stripping and grubbing operations to evaluate that all unsuitable materials are removed from locations for proposed construction.

Because of past use of the site, buried structures could be encountered such as foundations, utility lines, septic tanks, etc. If encountered, they should be removed and backfilled in accordance with requirements outlined in the Structural Fill section of this report.

During site preparation activities, the contractor should identify borrow source materials that will be used as structural fill and provide samples to the testing laboratory so that conformance to the Structural Fill requirements outlined below and appropriate moisture-density relationship curves can be determined.

4.2 SUBGRADE EVALUATION

We recommend that the project geotechnical engineer or a qualified representative evaluate the subgrade after the site is prepared. Some unsuitable or unstable areas may be present in unexplored areas of the site. All areas that will require fill or that will support structures should be carefully proofrolled with a heavy (40,000 # minimum), rubber-tired vehicle at the following times.

- After an area has been stripped, and undercut if required, prior to the placement of any fill.
- After grading an area to the finished subgrade elevation in the building area.
- After areas have been exposed to any precipitation, and/or have been exposed for more than 48 hours.

Some instability may exist during construction, depending on climatic and other factors immediately preceding and during construction. If any soft or otherwise unsuitable soils are identified during the proofrolling process, they must be undercut or stabilized prior to fill placement or floor slab construction. All unsuitable material identified during the construction shall be removed and replaced in accordance with the Structural Fill section of this report.

4.3 MOISTURE SENSITIVE SOILS

Moisture sensitive sandy clays (CL), silty sands (SM), and clayey sands (SC) were encountered near the surface during the subsurface exploration. These soils will degrade if allowed to become saturated. Therefore, not allowing water to pond by maintaining positive drainage and temporary dewatering methods (if required) is important to help avoid degradation and softening of the soils.

The contractor should anticipate some difficulty during the earthwork phase of this project if moisture levels are moderate to high during construction. Increased moisture levels will soften the subgrade and the soils may become unstable under the influence of construction traffic. Accordingly, construction during wet weather conditions should be avoided, as this could result in soft and unstable soil conditions that would require ground modification, such as in place stabilization or undercutting.

4.4 STRUCTURAL FILL

Requirements for structural fill on this project are as follows:

Soil Type	USCS Classification	Property Requirements	Placement Location
Sand and Gravel	GW, GP, GM, SW, SP, SM, or combinations	Maximum 2" particle size	All locations and depths with proper drainage
Clay	CL, SC, GC	LL<50, PI<25, γ_d > 100 pcf	All locations and depths
Clay	CH	N/A	Not suitable for fill placement
Silt	ML, MH	N/A	Not suitable for fill placement
On-site soils	CL, SC, SM, CH	As listed above	As listed above

Table 4: Structural Fill Requirements

Notes:

1. LL indicates the soil Liquid Limit; PI indicates the soil Plasticity Index; γ_d indicates the maximum dry density as defined by the density standard outlined in the table below.
2. Laboratory testing of the soils proposed for fill must be performed in order to verify their conformance with the above recommendations.
3. Any fill to be placed at the site should be reviewed by the geotechnical engineer.

Placement requirements for structural fill are as follows:

Specification	Requirement
Lift Thickness	Maximum 8-inch loose lifts when compacted with large heavy compaction equipment. Maximum 6-inch loose lifts when compacted with lightweight compaction equipment (thinner lifts may be required in confined locations)
Density	Minimum of 98 percent of maximum dry density as defined by ASTM D698 at all locations and depths.
Moisture	± 2 percent of optimum moisture as defined by ASTM D698 for cohesive soils. For cohesionless soils with greater than 2 percent passing the US Standard No. 200 sieve, ± 3 percent of optimum moisture as defined above. Moisture requirement is waived for cohesionless soil with less than 12 percent passing the No. 200 sieve.
Density Testing Frequency	One test per 2,500 sf in building areas and one test per 5,000 sf in pavement areas with minimum of 3 tests per lift. One test per 200 feet of trench backfill with minimum of 2 tests per lift. The testing frequency can be increased or decreased by the Geotechnical Engineer of Record in the field based on uniformity of material being placed and compactive effort used.

Table 5: Structural Fill Placement Requirements

4.5 EXCAVATION CONSIDERATIONS

All excavations performed at the site should follow OSHA guidelines for temporary excavations. Excavated soils should be stockpiled according to OSHA regulations to limit the potential cave-in of soils.

4.5.1 GROUNDWATER

Groundwater was encountered in B-01 at a depth of 18.5 feet below existing grade. Groundwater is not expected to be encountered during construction; although, it should be noted that fluctuations in the water level could occur due to seasonal variations in rainfall. Groundwater could be encountered at shallower depths during wet periods. The contractor must be prepared to remove groundwater seepage from excavations if encountered during construction. Excavations extending below groundwater levels will require dewatering systems (such as well points, sump pumps or trench drains). The contractor should evaluate the most economical and practical dewatering method.

4.6 LANDSCAPING AND DRAINAGE CONSIDERATION

The potential for soil moisture fluctuations within building areas and pavement subgrades should be reduced to lessen the potential of subgrade movement. Site grading should include positive drainage away from buildings and pavements. Excessive irrigation of landscaping poses a risk of saturating and softening soils below shallow footings and pavements, which could result in settlement of footings and premature failure of pavements.

4.7 WET WEATHER CONSTRUCTION

Excessive movement of construction equipment across the site during wet weather may result in ruts, which will collect rainwater, prolonging the time required to dry the subgrade soils.

During rainy periods, additional effort will be required to properly prepare the site and establish/maintain an acceptable subgrade. The difficulty will increase in areas where clay or silty soils are exposed at the subgrade elevation. Grading contractors typically postpone grading operations during wet weather to wait for conditions that are more favorable. Contractors can typically disk or aerate the upper soils to promote drying during intermittent periods of favorable weather. When deadlines restrict postponement of grading operations, additional measures such as undercutting and replacing saturated soils or stabilization can be utilized to facilitate placement of additional fill material.

5.0 FOUNDATION RECOMMENDATIONS

It is understood based on conversations with Karen Wright from LBYD that the individual column loads will be on the order of 150 kips. We assume that wall loads will be less than 5 kips per linear foot. ***If these assumptions concerning structural loading are incorrect, our office should be contacted, such that our recommendations can be reviewed.***

Based on the conditions encountered during our field investigation and after our site preparation and grading recommendations are implemented, the proposed structure can be supported on conventional shallow foundations resting on soil reinforced by aggregate piers. Aggregate piers are typically constructed by auguring 24-to-30-inch diameter holes and backfilling the holes with thin lifts of compacted/vibrated aggregate. Compaction/vibration densifies the aggregate and increases lateral stress in the soil matrix.

Aggregate piers are normally provided as a design build soil improvement with the installation contractor providing the design of the pier size, spacing, and depth. The aggregate piers are normally placed beneath isolated column foundations and load bearing continuous wall foundations to increase the allowable soil bearing capacity and limit total and differential settlement. Aggregate piers could also be placed below the grade supported slab to limit settlement. The use of aggregate piers for slab support should be verified once grading information and slab loading is available.

Specialty contractors, such as Keller® and Geopier®, provide this type of foundation system. The design and performance criteria for these systems are typically provided by the installation contractor. Shallow foundations bearing on soil reinforced with aggregate piers can typically be designed using a bearing capacity of 3,000 psf or greater, but the bearing capacity should be provided by the installation contractor.

Settlement is anticipated to be on the order of 1 inch using an aggregate pier system. A micropile foundation system can be considered to reduce settlement, if needed. However, rock coring will be required to provide rock parameters.

6.0 FLOOR SLABS

Site development recommendations presented in this report should be followed to provide for subgrade conditions suitable for support of grade supported slabs. Floor slabs will likely be supported on existing fill or newly placed structural fill.

We recommend floor slabs for the proposed structure be supported on a minimum 4-inch layer of DOT-approved graded aggregate base (GAB). The base should be moisture

conditioned and compacted to a minimum of 98% of the standard Proctor value. With the use of the graded aggregate base, a modulus of subgrade reaction of 125 pci can be used in the design of a grade-supported building floor slab.

We recommend a minimum 10-mil thick vapor retarder meeting ASTM E 1745, Class C requirements be placed directly below the slab-on-grade floors. A higher quality vapor retarder (Class A or B) may be used if desired to further inhibit the migration of moisture through the slab-on-grade and should be evaluated based on the floor covering and use. The vapor retarder should extend to the edge of the slab-on-grade floors and should be sealed at all seams and penetrations. The slab should be appropriately reinforced (if required) to support the proposed loads.

Where applicable, we recommend that the floor slab be isolated from the foundation footings so differential settlement of the structure will not induce shear stresses on the floor slab. Temperature and shrinkage reinforcements in slabs on grade may be considered and incorporated accordingly in the slab design. ACI 360-10 provides guidance on the proper quantity of such reinforcement. The slab should also be appropriately reinforced to support the proposed loads as required. If welded-wire mesh reinforcement is utilized, the mesh reinforcement should be placed 2 inches below the slab surface or upper one-third of the slab thickness, whichever is closer to the surface. Adequate construction joints, contraction joints and isolation joints should also be provided in the slab to reduce the impacts of cracking and shrinkage, in general accordance with ACI standards and guidelines (ACI360R-10).

7.0 SUBGRADE REHABILITATION

The subgrade soils often become disturbed during the period between initial site grading and construction of surface improvements. The amount and depth of disturbance will vary with soil type, weather conditions, construction traffic, and drainage.

The engineer should evaluate the subgrade soil during final grading to verify that the subgrade is suitable to receive pavement and/or concrete slab base materials. The final evaluation may include proofrolling or density tests.

Subgrade rehabilitation can become a point of controversy when different contractors are responsible for site grading and building construction. The construction documents should specifically state which contractor will be responsible for maintaining and rehabilitating the subgrade. Rehabilitation may include moisture conditioning and re-compacting soils. When deadlines or weather restrict grading operations, additional

measures such as undercutting and replacing saturated soils or chemical stabilization can often be utilized.

8.0 CONSTRUCTION MONITORING

Field verification of site conditions is an essential part of the services provided by the geotechnical consultant. In order to confirm our recommendations, it will be necessary for Building & Earth personnel to make periodic visits to the site during site grading. Typical construction monitoring services are listed below.

- Periodic observation and consultation by a member of our engineering staff during site development.
- Continuous monitoring during structural fill placement.
- Field density tests during structural fill placement.
- Continuous monitoring during installation of aggregate piers.
- Observation and verification of the bearing surfaces exposed after foundation excavation.
- Molding and testing of concrete cylinders.
- Observation and testing of masonry.
- Structural steel inspection.

9.0 CLOSING AND LIMITATIONS

This report was prepared for Jay Jenkins Architecture for specific application to the Calhoun County Jail Addition in Anniston, Alabama. The information in this report is not transferable. This report should not be used for a different development on the same property without first being evaluated by the engineer.

The recommendations in this report were based on the information obtained from our field exploration and laboratory analysis. The data collected is representative of the locations tested. Variations are likely to occur at other locations throughout the site. Engineering judgment was applied in regard to conditions between borings. It will be necessary to confirm the anticipated subsurface conditions during construction.

This report has been prepared in accordance with generally accepted standards of geotechnical engineering practice. No other warranty is expressed or implied. In the event that changes are made, or anticipated to be made, to the nature, design, or location of the project as outlined in this report, Building & Earth must be informed of the changes

and given the opportunity to either verify or modify the conclusions of this report in writing, or the recommendations of this report will no longer be valid.

The scope of services for this project did not include any environmental assessment of the site or identification of pollutants or hazardous materials or conditions. If the owner is concerned about environmental issues Building & Earth would be happy to provide an additional scope of services to address those concerns.

This report is intended for use during design and preparation of specifications and may not address all conditions at the site during construction. Contractors reviewing this information should acknowledge that this document is for design information only.

An article published by the Geoprofessional Business Association (GBA), titled *Important Information About Your Geotechnical Report*, has been included in the Appendix. We encourage all individuals to become familiar with the article to help manage risk.

Appendix Table of Contents

- GEOTECHNICAL INVESTIGATION METHODOLOGIES 1
 - DRILLING PROCEDURES – STANDARD PENETRATION TEST (ASTM D1586) 1
- BORING LOG DESCRIPTION 2
 - DEPTH AND ELEVATION 2
 - SAMPLE TYPE..... 2
 - SAMPLE NUMBER..... 2
 - BLOWS PER INCREMENT, REC%, RQD% 2
 - SOIL DATA 2
 - SOIL DESCRIPTION 3
 - GRAPHIC 3
 - REMARKS 3
- SOIL CLASSIFICATION METHODOLOGY..... 4
- KEY TO LOGS..... 6
- KEY TO HATCHES 8
- BORING LOCATION PLAN 9
- SUBSURFACE SOIL PROFILES..... 10
- BORING LOGS..... 11
- LABORATORY TEST PROCEDURES..... 12
 - DESCRIPTION OF SOILS (VISUAL-MANUAL PROCEDURE) (ASTM D2488) 12
 - POCKET PENETROMETER..... 12
 - NATURAL MOISTURE CONTENT (ASTM D2216) 12
 - ATTERBERG LIMITS (ASTM D4318)..... 12
 - MATERIAL FINER THAN NO. 200 SIEVE BY WASHING (ASTM D1140)..... 12
- LABORATORY TEST RESULTS..... 13
 - Table L-1: General Soil Classification Test Results 13
- IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL-ENGINEERING REPORT 14

GEOTECHNICAL INVESTIGATION METHODOLOGIES

The subsurface exploration, which is the basis of the recommendations of this report, has been performed in accordance with industry standards. Detailed methodologies employed in the investigation are presented in the following sections.

DRILLING PROCEDURES – STANDARD PENETRATION TEST (ASTM D1586)

At each boring location, soil samples were obtained at standard sampling intervals with a split-spoon sampler. The borehole was first advanced to the sample depth by augering and the sampling tools were placed in the open hole. The sampler was then driven 18 inches into the ground with a 140-pound automatic hammer free-falling 30 inches. The number of blows required to drive the sampler each 6-inch increment was recorded. The initial increment is considered the “seating” blows, where the sampler penetrates loose or disturbed soil in the bottom of the borehole.

The blows required to penetrate the final two (2) increments are added together and are referred to as the Standard Penetration Test (SPT) N-value. The N-value, when properly evaluated, gives an indication of the soil’s strength and ability to support structural loads. Many factors can affect the SPT N-value, so this result cannot be used exclusively to evaluate soil conditions.

The SPT testing was performed using a drill rig equipped with an automatic hammer. Automatic hammers mechanically control the height of the hammer drop, and doing so, deliver higher energy efficiency (90 to 99 % efficiency) than manual hammers (60 % efficiency) which are dropped using a manually operated rope and cathead system. Because historic data correlations were developed based on use of a manual hammer, it is necessary to adjust the N-values obtained using an automatic hammer to make these correlations valid. Therefore, an energy correction factor of 1.3 was applied to the recorded field N-values from the automatic hammer for the purpose of our evaluation. The N-values discussed or mentioned in this report and shown on the boring logs are recorded field values.

Samples retrieved from the boring locations were labeled and stored in plastic bags at the jobsite before being transported to our laboratory for analysis. The project engineer prepared Boring Logs summarizing the subsurface conditions at the boring locations.

BORING LOG DESCRIPTION

Building & Earth Sciences, Inc. used the gINT software program to prepare the attached boring logs. The gINT program provides the flexibility to custom design the boring logs to include the pertinent information from the subsurface exploration and results of our laboratory analysis. The soil and laboratory information included on our logs is summarized below:

DEPTH AND ELEVATION

The depth below the ground surface and the corresponding elevation are shown in the first two columns.

SAMPLE TYPE

The method used to collect the sample is shown. The typical sampling methods include Split Spoon Sampling, Shelby Tube Sampling, Grab Samples, and Rock Core. A key is provided at the bottom of the log showing the graphic symbol for each sample type.

SAMPLE NUMBER

Each sample collected is numbered sequentially.

BLOWS PER INCREMENT, REC%, RQD%

When Standard Split Spoon sampling is used, the blows required to drive the sampler each 6-inch increment are recorded and shown in column 5. When rock core is obtained the recovery ratio (REC%) and Rock Quality Designation (RQD%) is recorded.

SOIL DATA

Column 6 is a graphic representation of four different soil parameters. Each of the parameters use the same graph, however, the values of the graph subdivisions vary with each parameter. Each parameter presented on column 6 is summarized below:

- **N-value**- The Standard Penetration Test N-value, obtained by adding the number of blows required to drive the sampler the final 12 inches, is recorded. The graph labels range from 0 to 50.
- **Qu** – Unconfined Compressive Strength estimate from the Pocket Penetrometer test in tons per square foot (tsf). The graph labels range from 0 to 5 tsf.
- **Atterberg Limits** – The Atterberg Limits are plotted with the plastic limit to the left, and liquid limit to the right, connected by a horizontal line. The difference in the plastic and liquid limits is referred to as the Plasticity Index. The Atterberg Limits test results are also included in the Remarks column on the far right of the boring log. The Atterberg Limits graph labels range from 0 to 100%.
- **Moisture** – The Natural Moisture Content of the soil sample as determined in our laboratory.

SOIL DESCRIPTION

The soil description prepared in accordance with ASTM D2488, Visual Description of Soil Samples. The Munsel Color chart is used to determine the soil color. Strata changes are indicated by a solid line, with the depth of the change indicated on the left side of the line and the elevation of the change indicated on the right side of the line. If subtle changes within a soil type occur, a broken line is used. The Boring Termination or Auger Refusal depth is shown as a solid line at the bottom of the boring.

GRAPHIC

The graphic representation of the soil type is shown. The graphic used for each soil type is related to the Unified Soil Classification chart. A chart showing the graphic associated with each soil classification is included.

REMARKS

Remarks regarding borehole observations, and additional information regarding the laboratory results and groundwater observations.




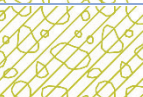

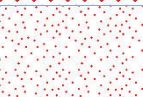
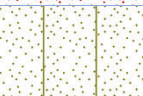
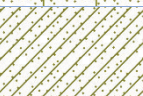

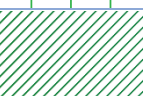
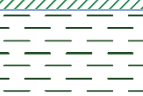




Major Divisions			Symbols		Group Name & Typical Description	
			Lithology	Group		
<p>Coarse Grained Soils</p> <p>More than 50% of material is larger than No. 200 sieve size</p>	<p>Gravel and Gravelly Soils</p> <p>More than 50% of coarse fraction is larger than No. 4 sieve</p>	<p>Clean Gravels</p> <p>(Less than 5% fines)</p>		GW	Well-graded gravels, gravel – sand mixtures, little or no fines	
				GP	Poorly-graded gravels, gravel – sand mixtures, little or no fines	
		<p>Gravels with Fines</p> <p>(More than 12% fines)</p>		GM	Silty gravels, gravel – sand – silt mixtures	
				GC	Clayey gravels, gravel – sand – clay mixtures	
	<p>Sand and Sandy Soils</p> <p>More than 50% of coarse fraction is smaller than No. 4 sieve</p>	<p>Clean Sands</p> <p>(Less than 5% fines)</p>		SW	Well-graded sands, gravelly sands, little or no fines	
				SP	Poorly-graded sands, gravelly sands, little or no fines	
		<p>Sands with Fines</p> <p>(More than 12% fines)</p>		SM	Silty sands, sand – silt mixtures	
				SC	Clayey sands, sand – clay mixtures	
	<p>Fine Grained Soils</p> <p>More than 50% of material is smaller than No. 200 sieve size</p>	<p>Silts and Clays</p> <p>Liquid Limit less than 50</p>	<p>Inorganic</p>		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silt with slight plasticity
					CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
Organic				OL	Organic silts and organic silty clays of low plasticity	
<p>Silts and Clays</p> <p>Liquid Limit greater than 50</p>		<p>Inorganic</p>		MH	Inorganic silts, micaceous or diatomaceous fine sand, or silty soils	
				CH	Inorganic clays of high plasticity	
		Organic		OH	Organic clays of medium to high plasticity, organic silts	
<p>Highly Organic Soils</p>				PT	Peat, humus, swamp soils with high organic contents	

Table 1: Soil Classification Chart (based on ASTM D2487)

Building & Earth Sciences classifies soil in general accordance with the Unified Soil Classification System (USCS) presented in ASTM D2487. Table 1 and Figure 1 exemplify the general guidance of the USCS. Soil consistencies and relative densities are presented in general accordance with Terzaghi, Peck, & Mesri's (1996) method, as shown on Table 2, when quantitative field and/or laboratory data is available. Table 2 includes Consistency and Relative Density correlations with N-values obtained using either a manual hammer (60 percent efficiency) or automatic hammer (90 percent efficiency). The *Blows Per Increment* and *SPT N-values* displayed on the boring logs are the unaltered values measured in the field. When field and/or laboratory data is not available, we may classify soil in general accordance with the Visual Manual Procedure presented in ASTM D2488.

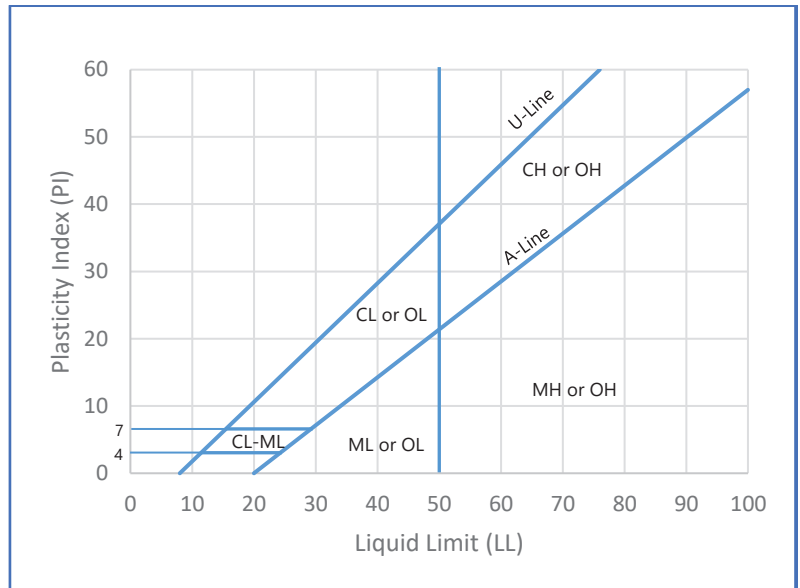


Figure 1: Plasticity Chart (based on ASTM D2487)

Non-cohesive: Coarse-Grained Soil		Cohesive: Fine-Grained Soil				
SPT Penetration (blows/foot)		Relative Density	SPT Penetration (blows/foot)		Consistency	Estimated Range of Unconfined Compressive Strength (tsf)
			Automatic Hammer*	Manual Hammer		
Automatic Hammer*	Manual Hammer		< 2	< 2	Very Soft	< 0.25
0 - 3	0 - 4	Very Loose	2 - 3	2 - 4	Soft	0.25 – 0.50
3 - 8	4 - 10	Loose	3 - 6	4 - 8	Medium Stiff	0.50 – 1.00
8 - 23	10 - 30	Medium Dense	6 - 12	8 - 15	Stiff	1.00 – 2.00
23 - 38	30 - 50	Dense	12 - 23	15 - 30	Very Stiff	2.00 – 4.00
> 38	> 50	Very Dense	> 23	> 30	Hard	> 4.00

Table 2: Soil Consistency and Relative Density (based on Terzaghi, Peck & Mesri, 1996)

* - Modified based on 80% hammer efficiency

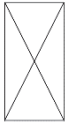







	Standard Penetration Test ASTM D1586 or AASHTO T-206		Dynamic Cone Penetrometer (Sower DCP) ASTM STP-399
	Shelby Tube Sampler ASTM D1587		No Sample Recovery
	Rock Core Sample ASTM D2113		Groundwater at Time of Drilling
	Auger Cuttings		Groundwater as Indicated

Table 1: Symbol Legend

Soil	Particle Size	U.S. Standard
Boulders	Larger than 300 mm	N.A.
Cobbles	300 mm to 75 mm	N.A.
Gravel	75 mm to 4.75 mm	3-inch to #4 sieve
Coarse	75 mm to 19 mm	3-inch to ¾-inch sieve
Fine	19 mm to 4.75 mm	¾-inch to #4 sieve
Sand	4.75 mm to 0.075 mm	#4 to #200 Sieve
Coarse	4.75 mm to 2 mm	#4 to #10 Sieve
Medium	2 mm to 0.425 mm	#10 to #40 Sieve
Fine	0.425 mm to 0.075 mm	#40 to #200 Sieve
Fines	Less than 0.075 mm	Passing #200 Sieve
Silt	Less than 5 µm	N.A.
Clay	Less than 2 µm	N.A.

Table 2: Standard Sieve Sizes





N-Value 	Standard Penetration Test Resistance calculated using ASTM D1586 or AASHTO T-206. Calculated as sum of original, field recorded values.	Atterberg Limits 	A measure of a soil's plasticity characteristics in general accordance with ASTM D4318. The soil Plasticity Index (PI) is representative of this characteristic and is bracketed by the Liquid Limit (LL) and the Plastic Limit (PL).
Qu 	Unconfined compressive strength, typically estimated from a pocket penetrometer. Results are presented in tons per square foot (tsf).	% Moisture 	Percent natural moisture content in general accordance with ASTM D2216.

Table 3: Soil Data

Hollow Stem Auger	Flights on the outside of the shaft advance soil cuttings to the surface. The hollow stem allows sampling through the middle of the auger flights.
Mud Rotary / Wash Bore	A cutting head advances the boring and discharges a drilling fluid to support the borehole and circulate cuttings to the surface.
Solid Flight Auger	Flights on the outside bring soil cuttings to the surface. Solid stem requires removal from borehole during sampling.
Hand Auger	Cylindrical bucket (typically 3-inch diameter and 8 inches long) attached to a metal rod and turned by human force.

Table 4: Soil Drilling Methods

Descriptor	Meaning
Trace	Likely less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

Table 5: Descriptors

Manual Hammer	The operator tightens and loosens the rope around a rotating drum assembly to lift and drop a sliding, 140-pound hammer falling 30 inches.
Automatic Trip Hammer	An automatic mechanism is used to lift and drop a sliding, 140-pound hammer falling 30 inches.
Dynamic Cone Penetrometer (Sower DCP) ASTM STP-399	Uses a 15-pound steel mass falling 20 inches to strike an anvil and cause penetration of a 1.5-inch diameter cone seated in the bottom of a hand augered borehole. The blows required to drive the embedded cone a depth of 1-3/4 inches have been correlated by others to N-values derived from the Standard Penetration Test (SPT).

Table 6: Sampling Methods

Non-plastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be re-rolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be re-rolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

Table 7: Plasticity

Dry	Absence of moisture, dusty, dry to the touch.
Moist	Damp but no visible water.
Wet	Visible free water, usually soil is below water table.

Table 8: Moisture Condition

Stratified	Alternating layers of varying material or color with layers at least 1/2 inch thick.
Laminated	Alternating layers of varying material or color with layers less than 1/4 inch thick.
Fissured	Breaks along definite planes of fracture with little resistance to fracturing.
Slickensides	Fracture planes appear polished or glossy, sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay.
Homogeneous	Same color and appearance throughout.

Table 9: Structure

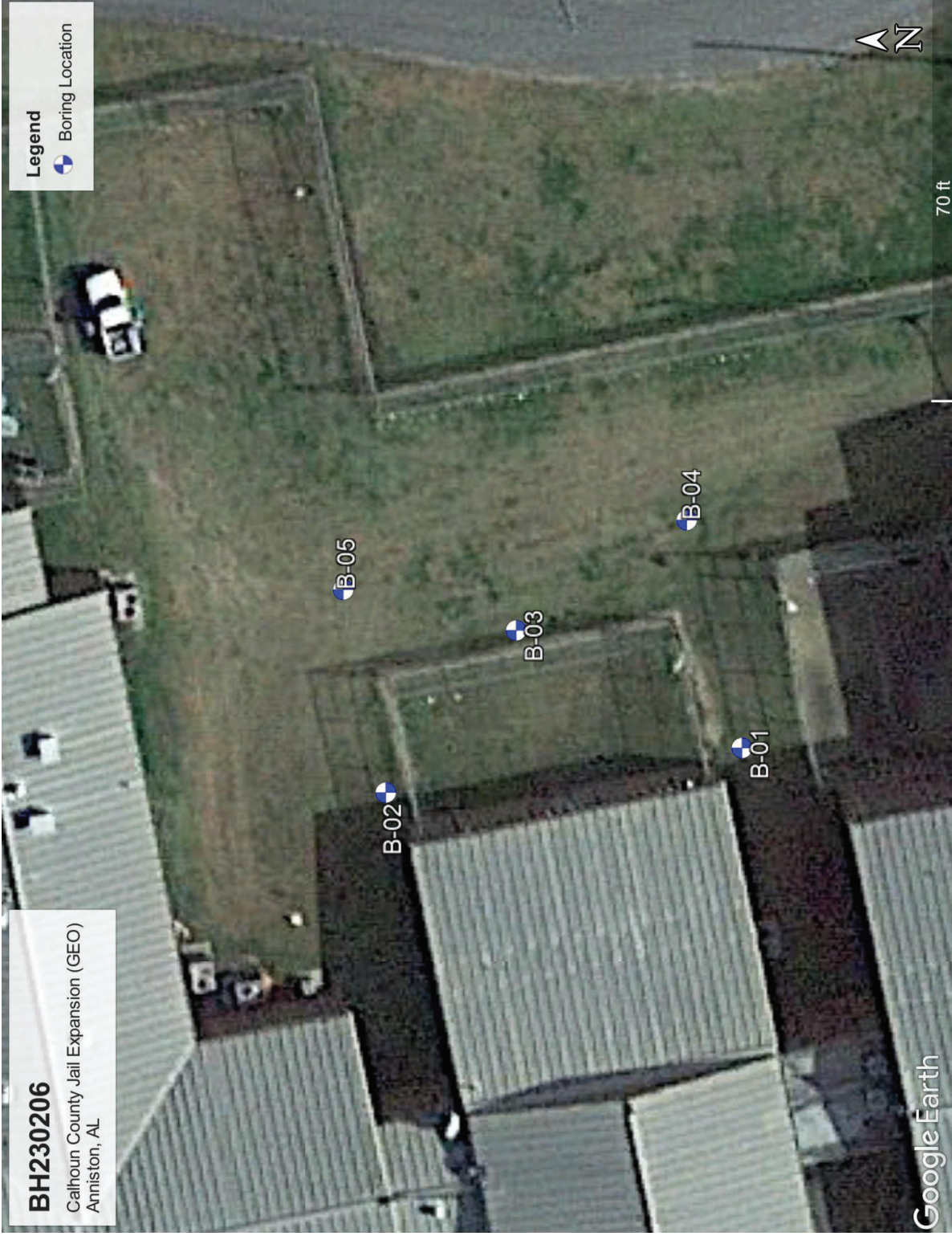
Hatch	Description	Hatch	Description	Hatch	Description
	GW - Well-graded gravels, gravel – sand mixtures, little or no fines		Asphalt		Clay with Gravel
	GP - Poorly-graded gravels, gravel – sand mixtures, little or no fines		Aggregate Base		Sand with Gravel
	GM - Silty gravels, gravel – sand – silt mixtures		Topsoil		Silt with Gravel
	GC - Clayey gravels, gravel – sand – clay mixtures		Concrete		Gravel with Sand
	SW - Well-graded sands, gravelly sands, little or no fines		Coal		Gravel with Clay
	SP - Poorly-graded sands, gravelly sands, little or no fines		CL-ML - Silty Clay		Gravel with Silt
	SM - Silty sands, sand – silt mixtures		Sandy Clay		Limestone
	SC - Clayey sands, sand – clay mixtures		Clayey Chert		Chalk
	ML - Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silt with slight plasticity		Low and High Plasticity Clay		Siltstone
	CL - Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		Low Plasticity Silt and Clay		Till
	OL - Organic silts and organic silty clays of low plasticity		High Plasticity Silt and Clay		Sandy Clay with Cobbles and Boulders
	MH - Inorganic silts, micaceous or diatomaceous fine sand, or silty soils		Fill		Sandstone with Shale
	CH - Inorganic clays of high plasticity		Weathered Rock		Coral
	OH - Organic clays of medium to high plasticity, organic silts		Sandstone		Boulders and Cobbles
	PT - Peat, humus, swamp soils with high organic contents		Shale		Soil and Weathered Rock

Table 1: Key to Hatches Used for Boring Logs and Soil Profiles

BORING LOCATION PLAN

BH230206

Calhoun County Jail Expansion (GEO)
Anniston, AL



Google Earth

Reference used to produce this drawing:

Google Earth

BORING LOCATION PLAN



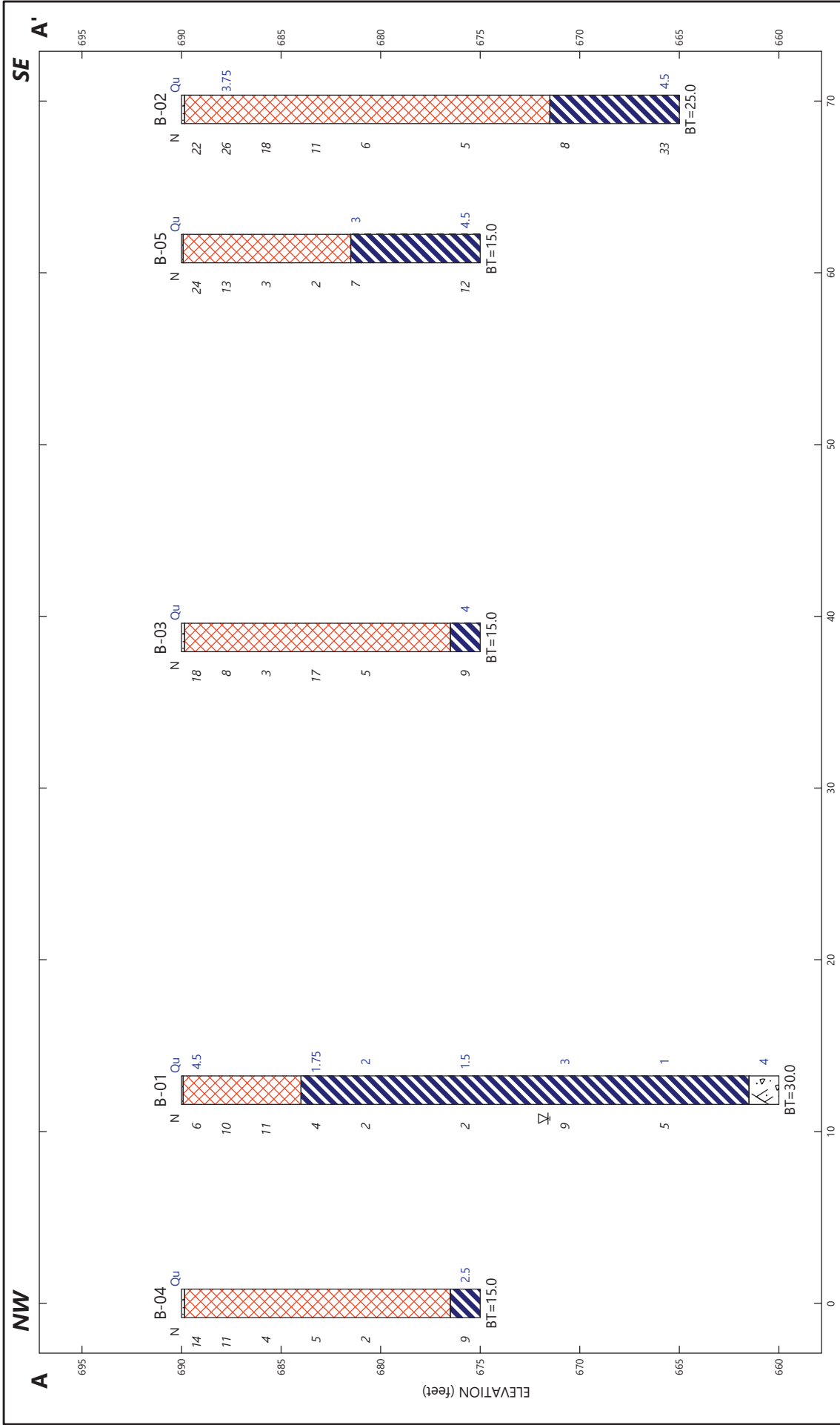
PROJECT NO.:
BH230206

PROJECT NAME / LOCATION:
Calhoun County Jail Addition / Anniston, AL

SCALE:
As Shown

DATE:
8/2/2023

SUBSURFACE SOIL PROFILES



Building & Earth Sciences, Inc.
 5545 Derby Drive, Birmingham, AL 35201
 Calhoun County Jail Expansion
 Anniston, AL

**A-A': Subsurface Profile
 Addition Profile**

PROJECT NO: BH230206 PLATE NO: A-1 DATE: 8/2/23

BUILDING & EARTH
 Geotechnical, Environmental, and Materials Engineers

Legend

BT= Boring Termination, TPT= Test Pit Terminated
 AR= Auger Refusal, ER= Excavation Refusal
 N= Standard Penetration Test N-Value
 Qu= Unconfined compressive strength estimate from pocket penetrometer test (tsf)
 ▽ Water Level Reading at time of drilling.
 ▽ Water Level Reading after drilling.

Key to Hatches

- Topsoil
- Weathered Rock
- Fill
- USCS High Plasticity Clay

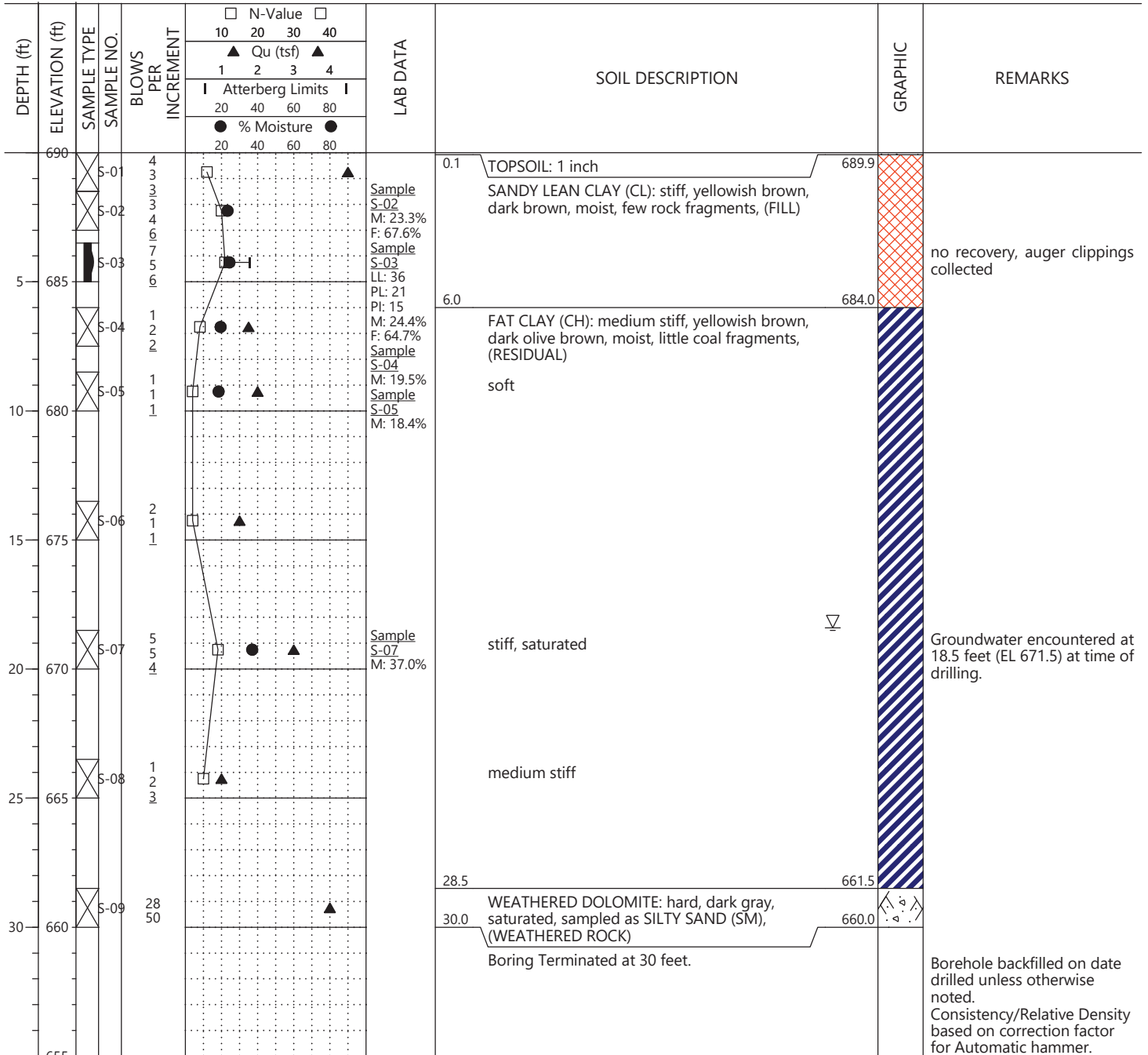
Horizontal Scale (feet): 0 to 8
 Vertical Exaggeration: 1x

Site Map Scale: 1 inch equals 50 feet

BORING LOGS

PROJECT NAME: Calhoun County Jail Expansion
PROJECT NUMBER: BH230206
DRILLING METHOD: Hollow Stem Auger
EQUIPMENT USED: Geoprobe 7822DT
HAMMER TYPE: Automatic
BORING LOCATION: SW Addition Corner

LOCATION: Anniston, AL
DATE DRILLED: 7/18/23
WEATHER: clear, sunny, 84
ELEVATION: 690
DRILL CREW: Building & Earth
LOGGED BY: M. Sinople

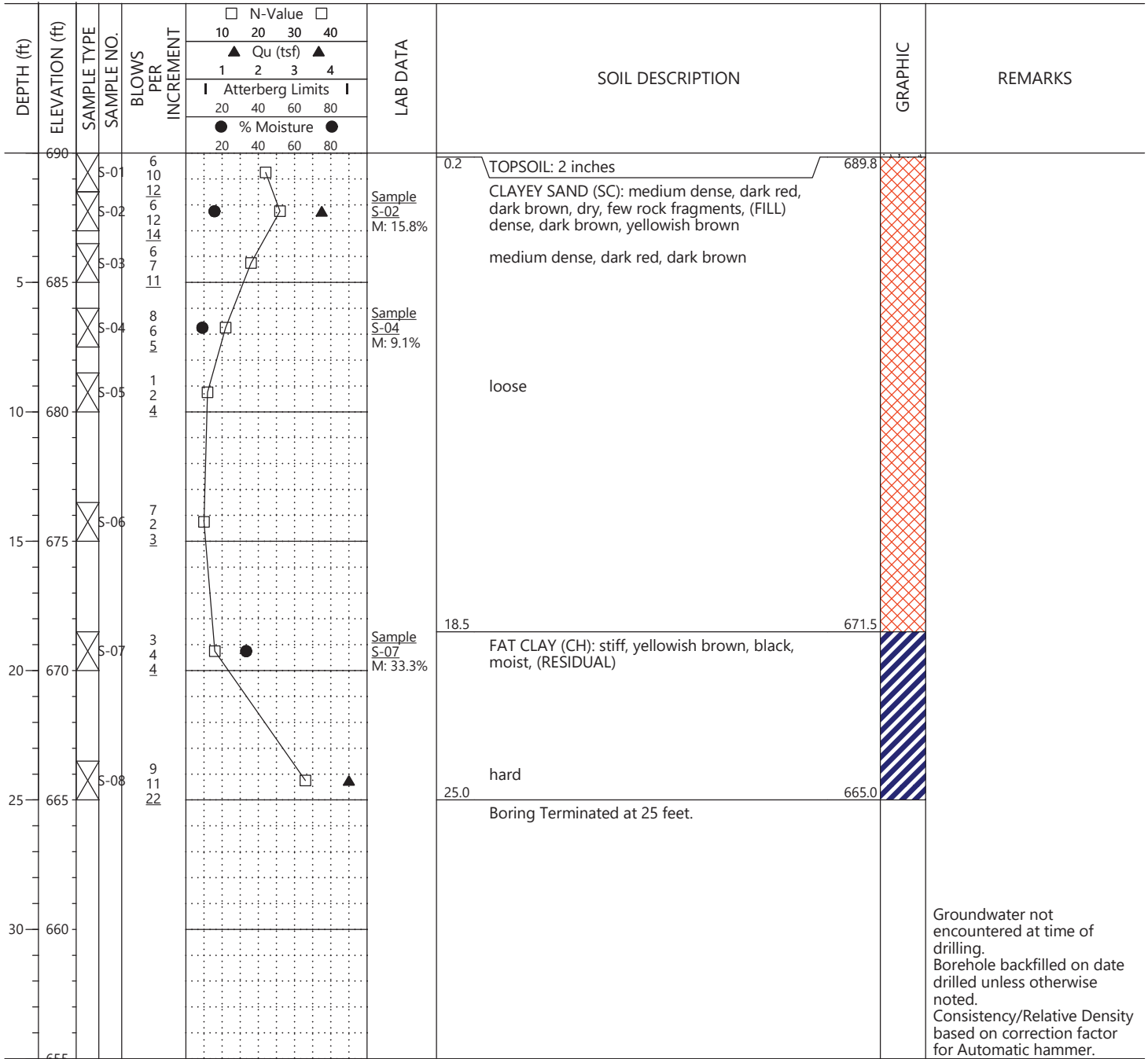


SAMPLE TYPE Split Spoon Auger Cuttings

N-VALUE	STANDARD PENETRATION RESISTANCE (AASHTO T-206)	REC	RECOVERY	LL:	LIQUID LIMIT	M:	NATURAL MOISTURE CONTENT
% MOISTURE	PERCENT NATURAL MOISTURE CONTENT	RQD	ROCK QUALITY DESIGNATION	PL:	PLASTIC LIMIT	F:	PERCENT PASSING NO. 200 SIEVE
	GROUNDWATER LEVEL IN THE BOREHOLE AT TIME OF DRILLING	UD	UNDISTURBED	PI:	PLASTICITY INDEX		
	STABILIZED GROUNDWATER LEVEL	Qu	POCKET PENETROMETER UNCONFINED COMPRESSIVE STRENGTH				

PROJECT NAME: Calhoun County Jail Expansion
PROJECT NUMBER: BH230206
DRILLING METHOD: Hollow Stem Auger
EQUIPMENT USED: Geoprobe 7822DT
HAMMER TYPE: Automatic
BORING LOCATION: NW Addition Corner

LOCATION: Anniston, AL
DATE DRILLED: 7/18/23
WEATHER: clear, sunny, 92
ELEVATION: 690
DRILL CREW: Building & Earth
LOGGED BY: M. Sinople



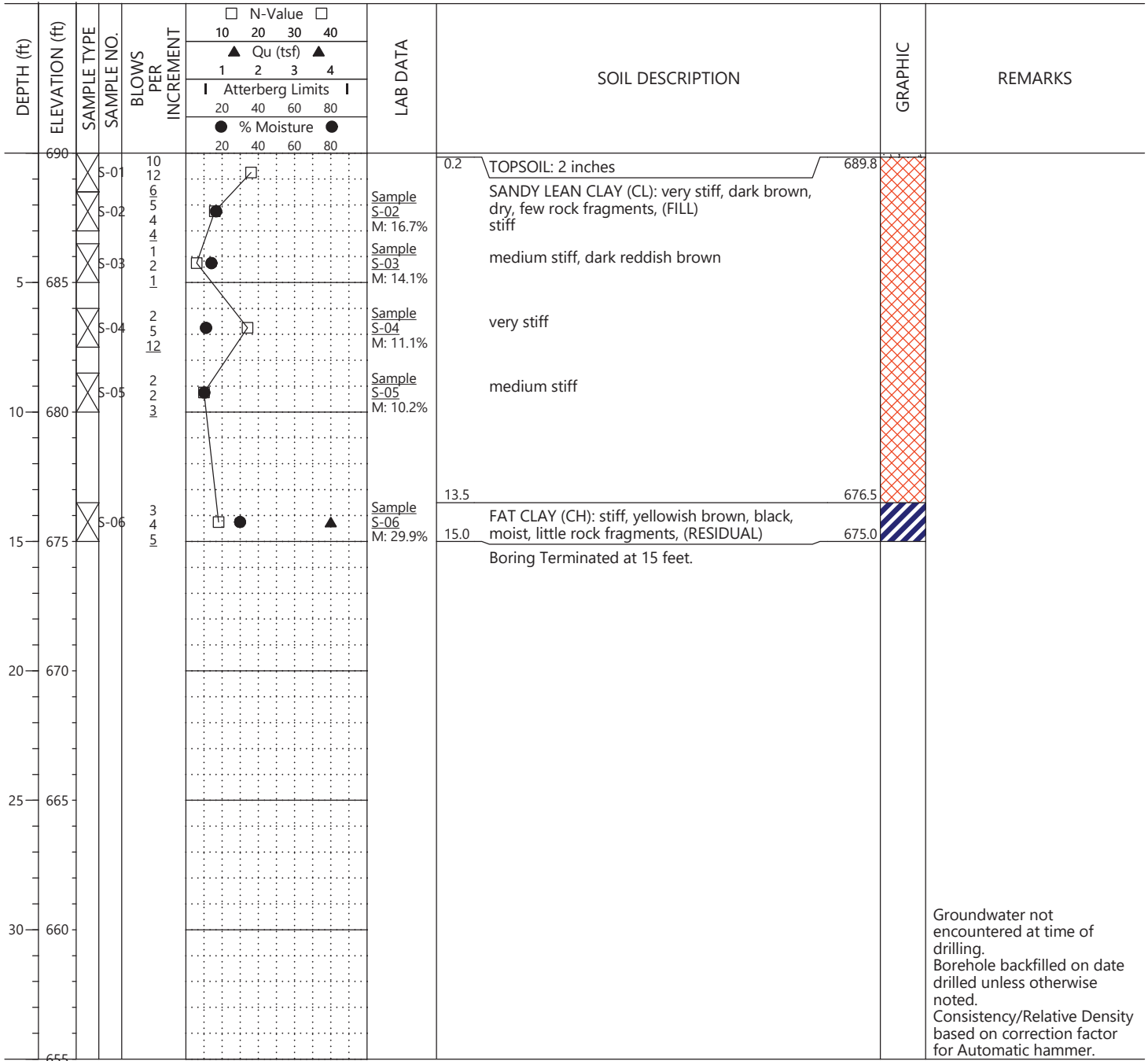
SAMPLE TYPE Split Spoon

N-VALUE STANDARD PENETRATION RESISTANCE (AASHTO T-206) **REC** RECOVERY **LL:** LIQUID LIMIT **M:** NATURAL MOISTURE CONTENT
% MOISTURE PERCENT NATURAL MOISTURE CONTENT **RQD** ROCK QUALITY DESIGNATION **PL:** PLASTIC LIMIT **F:** PERCENT PASSING NO. 200 SIEVE
 GROUNDWATER LEVEL IN THE BOREHOLE AT TIME OF DRILLING **UD** UNDISTURBED **PI:** PLASTICITY INDEX
 STABILIZED GROUNDWATER LEVEL **Qu** POCKET PENETROMETER UNCONFINED COMPRESSIVE STRENGTH

Groundwater not encountered at time of drilling. Borehole backfilled on date drilled unless otherwise noted. Consistency/Relative Density based on correction factor for Automatic hammer.

PROJECT NAME: Calhoun County Jail Expansion
PROJECT NUMBER: BH230206
DRILLING METHOD: Hollow Stem Auger
EQUIPMENT USED: Geoprobe 7822DT
HAMMER TYPE: Automatic
BORING LOCATION: Center of Addition

LOCATION: Anniston, AL
DATE DRILLED: 7/18/23
WEATHER: clear sunny, 90
ELEVATION: 690
DRILL CREW: Building & Earth
LOGGED BY: M. Sinople



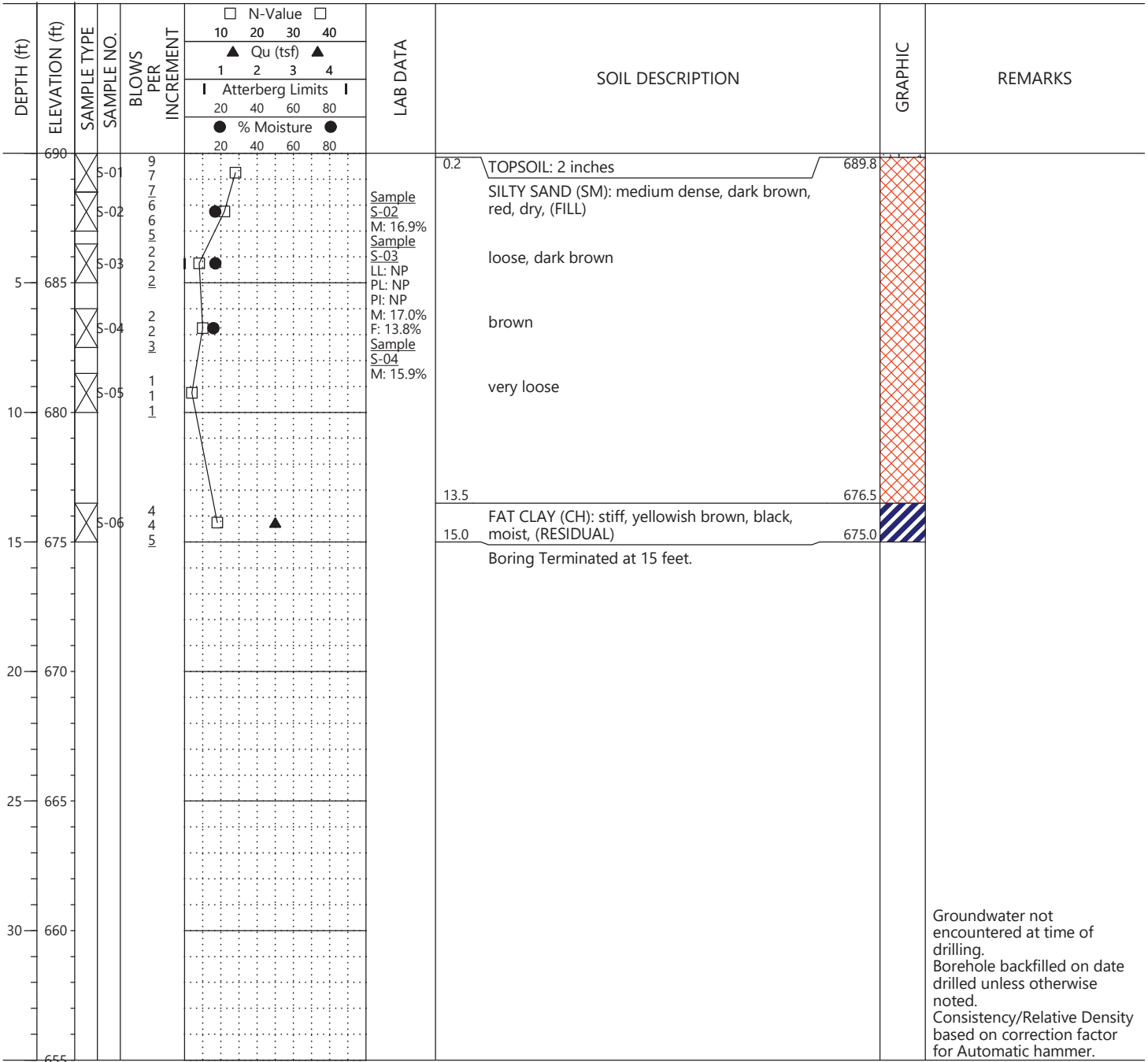
SAMPLE TYPE Split Spoon

N-VALUE STANDARD PENETRATION RESISTANCE (AASHTO T-206) **REC** RECOVERY **LL:** LIQUID LIMIT **M:** NATURAL MOISTURE CONTENT
% MOISTURE PERCENT NATURAL MOISTURE CONTENT **RQD** ROCK QUALITY DESIGNATION **PL:** PLASTIC LIMIT **F:** PERCENT PASSING NO. 200 SIEVE
 GROUNDWATER LEVEL IN THE BOREHOLE AT TIME OF DRILLING **UD** UNDISTURBED **PI:** PLASTICITY INDEX
 STABILIZED GROUNDWATER LEVEL **Qu** POCKET PENETROMETER UNCONFINED COMPRESSIVE STRENGTH

Groundwater not encountered at time of drilling. Borehole backfilled on date drilled unless otherwise noted. Consistency/Relative Density based on correction factor for Automatic hammer.

PROJECT NAME: Calhoun County Jail Expansion
PROJECT NUMBER: BH230206
DRILLING METHOD: Hollow Stem Auger
EQUIPMENT USED: Geoprobe 7822DT
HAMMER TYPE: Automatic
BORING LOCATION: SE Addition Corner

LOCATION: Anniston, AL
DATE DRILLED: 7/18/23
WEATHER:
ELEVATION: 690
DRILL CREW: Building & Earth
LOGGED BY: M. Sinople



Groundwater not encountered at time of drilling. Borehole backfilled on date drilled unless otherwise noted. Consistency/Relative Density based on correction factor for Automatic hammer.

N-VALUE STANDARD PENETRATION RESISTANCE (AASHTO T-206) **REC** RECOVERY **LL:** LIQUID LIMIT **M:** NATURAL MOISTURE CONTENT
% MOISTURE PERCENT NATURAL MOISTURE CONTENT **RQD** ROCK QUALITY DESIGNATION **PL:** PLASTIC LIMIT **F:** PERCENT PASSING NO. 200 SIEVE
 GROUNDWATER LEVEL IN THE BOREHOLE AT TIME OF DRILLING **UD** UNDISTURBED **PI:** PLASTICITY INDEX
 STABILIZED GROUNDWATER LEVEL **Qu** POCKET PENETROMETER UNCONFINED COMPRESSIVE STRENGTH

PROJECT NAME: Calhoun County Jail Expansion
PROJECT NUMBER: BH230206
DRILLING METHOD: Hollow Stem Auger
EQUIPMENT USED: Geoprobe 7822DT
HAMMER TYPE: Automatic
BORING LOCATION: NE Addition Corner

LOCATION: Anniston, AL
DATE DRILLED: 7/18/23
WEATHER: clear, sunny, 90
ELEVATION: 690
DRILL CREW: Building & Earth
LOGGED BY: M. Sinople

DEPTH (ft)	ELEVATION (ft)	SAMPLE TYPE	SAMPLE NO.	BLOWS PER INCREMENT	LAB DATA				SOIL DESCRIPTION	GRAPHIC	REMARKS
					□ N-Value □	▲ Qu (tsf) ▲	▭ Atterberg Limits ▭	● % Moisture ●			
690											
		Split Spoon	S-01	12				0.1 TOPSOIL: 1 inch			
		Split Spoon	S-02	12				CLAYEY SAND (SC): dense, dark brown, dry, little rock fragments, (FILL) medium dense, brownish yellow, brown			
		Split Spoon	S-03	8				loose, dark reddish brown			
5	685	Split Spoon	S-04	1				very loose			
		Split Spoon	S-05	2				8.5			
10	680			5				FAT CLAY (CH): stiff, yellowish brown, moist, (RESIDUAL)			
		Split Spoon	S-06	12				15.0			
15	675			7				Boring Terminated at 15 feet.			
20	670										
25	665										
30	660										
										Groundwater not encountered at time of drilling. Borehole backfilled on date drilled unless otherwise noted. Consistency/Relative Density based on correction factor for Automatic hammer.	
655											

SAMPLE TYPE Split Spoon

N-VALUE STANDARD PENETRATION RESISTANCE (AASHTO T-206) **REC** RECOVERY **LL:** LIQUID LIMIT **M:** NATURAL MOISTURE CONTENT
% MOISTURE PERCENT NATURAL MOISTURE CONTENT **RQD** ROCK QUALITY DESIGNATION **PL:** PLASTIC LIMIT **F:** PERCENT PASSING NO. 200 SIEVE
 GROUNDWATER LEVEL IN THE BOREHOLE AT TIME OF DRILLING **UD** UNDISTURBED **PI:** PLASTICITY INDEX
 STABILIZED GROUNDWATER LEVEL **Qu** POCKET PENETROMETER UNCONFINED COMPRESSIVE STRENGTH

LABORATORY TEST PROCEDURES

A brief description of the laboratory tests performed is provided in the following sections.

DESCRIPTION OF SOILS (VISUAL-MANUAL PROCEDURE) (ASTM D2488)

The soil samples were visually examined by our engineer and soil descriptions were provided. Representative samples were then selected and tested in accordance with the aforementioned laboratory-testing program to determine soil classifications and engineering properties. This data was used to correlate our visual descriptions with the Unified Soil Classification System (USCS).

POCKET PENETROMETER

Pocket Penetrometer tests were performed on cohesive soil samples. The pocket penetrometer provides a consistency classification, and an indication of the soils unconfined compressive strength (Q_u).

NATURAL MOISTURE CONTENT (ASTM D2216)

Natural moisture contents (M%) were determined on selected samples. The natural moisture content is the ratio, expressed as a percentage, of the weight of water in a given amount of soil to the weight of solid particles.

ATTERBERG LIMITS (ASTM D4318)

The Atterberg Limits test was performed to evaluate the soil's plasticity characteristics. The soil Plasticity Index (PI) is representative of this characteristic and is bracketed by the Liquid Limit (LL) and the Plastic Limit (PL). The Liquid Limit is the moisture content at which the soil will flow as a heavy viscous fluid. The Plastic Limit is the moisture content at which the soil is between "plastic" and the semi-solid stage. The Plasticity Index ($PI = LL - PL$) is a frequently used indicator for a soil's potential for volume change. Typically, a soil's potential for volume change increases with higher plasticity indices.

MATERIAL FINER THAN NO. 200 SIEVE BY WASHING (ASTM D1140)

Grain-size tests were performed to determine the partial soil particle size distribution. The amount of material finer than the openings on the No. 200 sieve (0.075 mm) was determined by washing soil over the No. 200 sieve. The results of wash #200 tests are presented on the boring logs included in this report and in the table of laboratory test results.

LABORATORY TEST RESULTS

The results of the laboratory testing are presented in the following tables.

BORING NO.	DEPTH	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	% PASSING #200 SIEVE	CLASSIFICATION
B-01	1.5 - 3.0	23.3					
B-01	3.5 - 5.0	24.4	36	21	15	65	CL
B-01	6.0 - 7.5	19.5					
B-01	8.5 - 10.0	18.4					
B-01	18.5 - 20.0	37.0					
B-02	1.5 - 3.0	15.8					
B-02	6.0 - 7.5	9.1					
B-02	18.5 - 20.0	33.3					
B-03	1.5 - 3.0	16.7					
B-03	3.5 - 5.0	14.1					
B-03	6.0 - 7.5	11.1					
B-03	8.5 - 10.0	10.2					
B-03	13.5 - 15.0	29.9					
B-04	1.5 - 3.0	16.9					
B-04	3.5 - 5.0	17.0	NP	NP	NP	14	SM
B-04	6.0 - 7.5	15.9					

TABLE L-1: General Soil Classification Test Results

Soils with a Liquid Limit (LL) greater than 50 and Plasticity Index (PI) greater than 25 usually exhibit significant volume change with varying moisture content and are considered to be highly plastic
(1) Indicates visual classification. WR indicates weathered rock.

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you — should apply this report for any purpose or project except the one originally contemplated.*

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an

assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by:* the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly

problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time to perform additional study.* Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help

others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold-prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical-engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your GBC-Member geotechnical engineer for more information.



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e-mail: info@geoprofessional.org www.geoprofessional.org

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Geotechnical, Environmental, and Materials Engineers

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Birmingham, AL 35210
Ph: (205) 836-6300
www.BuildingAndEarth.com

January 12, 2024

Calhoun County Commission
1702 Noble Street, Suite 103
Anniston, AL 36201

Attention: Ms. Anna Harris (anna@jayjenkinsarchitecture.com)

Subject: Addendum Letter #1
Calhoun County Jail Expansion
Anniston, Alabama
Building & Earth Project No.: BH230206

Dear Ms. Harris:

Building & Earth Sciences, Inc. is pleased to provide this addendum to our Geotechnical Report, dated August 2, 2023. The purpose of this addendum is to provide clarification on undercut beneath the floor slab in the proposed structure. It is understood that 2 feet of fill will be necessary to bring the site to finished grade. After the topsoil is stripped, a subgrade evaluation by proofroll should be performed under the observation of the geotechnical engineer or his representative to identify any soft and unstable areas prior to placing fill material.

Unstable areas identified during the proofroll should be undercut to a suitable, stable grade or stabilized in place. Stabilization options should be provided during construction based on the subgrade evaluation. Based on our borings, unstable conditions are expected in the vicinity of boring B-01 within the upper 1.5 feet; however, subgrade stability is highly dependent on weather conditions. We recommend that grading operations be avoided during wet weather or winter months, as this could result in soft and unstable conditions that would require in place stabilization or undercutting.

Based on our conversations, slab loading will be normal and lightly loaded. Based on this information, it is our opinion that the floor slab can be supported on structural fill without aggregate piers. Aggregate piers can be considered to support the floor slab to reduce any necessary undercutting/stabilization or mitigate the potential risk of excessive settlement; however, some stabilization still may be necessary to create a stable platform for aggregate pier installation equipment if unstable conditions are encountered during construction.

Birmingham, AL • Auburn, AL • Huntsville, AL • Montgomery, AL
Tuscaloosa, AL • Columbus, GA • Louisville, KY • Raleigh, NC • Dunn, NC
Jacksonville, NC • Springdale, AR • Little Rock, AR • Ft. Smith, AR • Tulsa, OK
Oklahoma City, OK • DFW Metroplex, TX • Virginia Beach, VA • Nashville, TN


It is our understanding that vibration from the installation of aggregate piers may be unacceptable for the project. A micropile foundation system can be considered as an alternative to reduce vibration during foundation installation and reduce expected settlement. Additional recommendations can be provided if micropiles are utilized for foundation support.

We appreciate the opportunity to continue working with you on this project. If you have any further questions or need clarification, please call us.

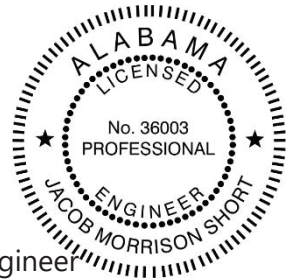
Respectfully Submitted,
BUILDING & EARTH SCIENCES, INC.



Rodney Collins, Ph.D., P.E.
Project Engineer



Jacob Short, P.E.
Senior Geotechnical Engineer



**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

TABLE OF CONTENTS

02 41 13	Selective Site Demolition
03 20 00	Concrete Reinforcing
03 30 00	Cast-in-Place Concrete
31 00 00	Earthwork
31 05 17	Aggregate Materials
31 10 00	Site Clearing
31 23 33	Trenching and Backfilling
31 25 00	Erosion and Sedimentation Controls
31 37 00	Rip Rap
32 11 23	Aggregate Base Course
32 12 00	Flexible Paving
33 01 30.13	Sewer and Manhole Testing
33 05 13	Manholes and Structures
33 12 00	Water Utility Distribution Equipment
33 12 13	Water Service Connections
33 13 00	Disinfection of Water Utility Distribution
33 31 00	Sanitary Utility Sewerage Piping
33 44 00	Storm Utility Water Drains
40 05 76.13	Tapping Sleeves and Valves

END OF SECTION



**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

**SECTION 02 41 13
SELECTIVE SITE DEMOLITION**

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Demolishing designated building equipment and fixtures.
 - 2. Demolishing designated construction.
 - 3. Cutting and alterations for completion of the Work.
 - 4. Removing designated items for Owner's retention.
 - 5. Protecting items designated to remain.
 - 6. Removing demolished materials.
- B. Related Sections:
 - 1. Drawings and general provisions of the Contract including General and Supplementary Conditions, Special Conditions, Technical Specifications, and General Requirements.

1.2 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures.
- B. Demolition Schedule: Indicate overall schedule and interruptions required for utility and building services.
- C. Shop Drawings:
 - 1. Indicate demolition and removal sequence.
 - 2. Indicate location of items designated for Owner's retention.
 - 3. Indicate location and construction of temporary work.

1.3 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution Requirements.
- B. Project Record Documents: Accurately record actual locations of capped utilities, concealed utilities discovered during demolition, and subsurface obstructions.
- C. Operation and Maintenance Data: Submit description of system, inspection data, and parts lists.

1.4 QUALITY ASSURANCE

- A. Conform to applicable code for demolition work, dust control, products requiring electrical disconnection and re-connection.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

- B. Conform to applicable code for procedures when hazardous or contaminated materials are discovered.
- C. Obtain required permits from authorities having jurisdiction.

1.5 SCHEDULING

- A. Schedule Work to coincide with new construction.
- B. Cooperate with Owner in scheduling noisy operations and waste removal that may impact Owners operation.
- C. Coordinate utility service interruptions with Owner.
 - 1. Do not disable or disrupt building existing utility systems without two days prior written notice to Owner.
 - 2. Schedule tie-ins to existing systems to minimize disruption.

1.6 PROJECT CONDITIONS

- A. Conduct demolition to minimize interference with adjacent and occupied building areas.
- B. Cease operations immediately if structure appears to be in danger and notify Engineer. Do not resume operations until directed.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 PREPARATION

- A. Notify affected utility companies before starting work and comply with their requirements.
- B. Mark location and termination of utilities.
- C. Erect, and maintain temporary barriers and security devices, including warning signs and lights, and similar measures, for protection of the public.

3.2 SALVAGE REQUIREMENTS

- A. Coordinate with Owner to identify items and equipment required to be removed and delivered to Owner.
- B. Tag components and equipment Owner designates for salvage.
- C. Protect designated salvage items from demolition operations until items can be removed.

*CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA*

- D. Carefully remove items and equipment indicated to be salvaged.
- E. Disassemble as required to permit removal.
- F. Deliver salvaged items to Owner. Obtain signed receipt from Owner.

3.3 DEMOLITION

- A. Conduct demolition to minimize interference with adjacent and occupied building areas.
- B. Do not close or obstruct roadways or walkways without permits.
- C. Cease operations immediately when structure appears to be in danger and notify Engineer.
- D. Disconnect and remove designated utilities within demolition areas.
- E. Cap and identify abandoned utilities at termination points when utility is not completely removed. Annotate Record Drawings indicating location and type of service for capped utilities remaining after demolition.
- F. Demolish in orderly and careful manner. Protect existing facilities.
- G. Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.
- H. Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.
- I. Remove temporary Work.

END OF SECTION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 2: SITEWORK
Section 02 83 10: Chain Link Fences and Gates

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and any general provisions of the Contract for each Prime Contract, including General and Supplementary Conditions and specific requirements apply to this Section.

1.02 GENERAL:

- a. Provide galvanized chain-link fencing products, including related personnel and vehicular gates, as shown on drawings and as specified herein. Products shall be in final configuration as selected by Architect. .
- b. Include key operated gate locks for swinging fence gates as specified herein.
- c. Electric locks are included and specified in "Detention Equipment" Section - Division 11.
- d. All Perimeter Security fencing shall be galvanized products as detailed and specified.

1.03 QUALITY ASSURANCE:

- a. BASIS OF SPECIFICATIONS:
 - 1. Fence and Gates: American Fence Corp.
 - 2. Razor Ribbon: American Fence Corp. (LL BTO) and (BTC).
 - 3. Equal products by Allied Tube and Conduit.
- b. ACCEPTABLE MANUFACTURERS:
 - 1. Fence and Gates: Anchor Fence, Inc., Allied Tube and Conduit.
 - 2. Razor Ribbon: Man Barrier Corporation (Long BTC).
 - 3. Gate Operators: Hy-Security Gate Operators

1.04 SUBMITTALS:

- a. SHOP DRAWINGS: Submit drawings showing fence layout and installation details. Include and show provisions for gates, gate operators and gate hardware. Identify all components of fencing and gate construction.

1.05 DELIVERY, STORAGE AND HANDLING:

- a. Deliver and store materials in manner recommended by manufacturer to prevent damage to material and finish coating on materials and equipment furnished.

1.06 PRODUCTS:

- a. CHAIN-LINK FENCE FABRIC: One-piece fabric width for full height of fence, #9 gauge-nominal 2" mesh galvanized, with top and bottom selvages twisted and barbed. Fabric and

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

coating meeting the requirements of ASTM F668, zinc-coated by the electrolytic process, or aluminum-coated by the hot-dip method. Fabric wires shall be galvanized with not less than 2.0 ounce zinc per square feet, complying with ASTM A-392, Class I.

- b. FRAMEWORK: Galvanized steel pipe per ASTM A-120 (1.8 ounce zinc PSF) or galvanized structural and roll formed shapes per ASTM A-123 (2.0 ounce zinc PSF). Framework members shall be TUF-40 class 1 grade B quality unless otherwise noted. Minimum size members as follows:

1. Line Posts: 2.875' O.D. pipe weighing 4.64 pounds per foot. Same applicable for hood posts at inner fence. See details.
2. Terminal Posts: 4" O.D. Pipe weighing 6.56 pounds per linear foot.
3. Gate Posts for Swinging Gates (up to and including 6'-0" width): 2.875 O.D. pipe weighing 4.64 pounds per foot.
4. Horizontal Rails and Post Braces: 1.660" O.D. pipe weighing 1.82 pounds per linear foot.
5. Pull posts: 2.875 O.D. pipe weighing 4.64 pounds per lineal foot.
6. Include top and bottom rail for all fence and include all post braces for each gate on pull posts per top rail manufacturer's recommendations for conditions involved.
7. Truss Rods: Provide truss rod above and below horizontal rails at each corner section.
8. All products shall be galvanized vinyl coated in standard color as selected. Fabric and coating meeting the requirements of ASTM F668, class 2b PVC coating shall be fused and adhered to a primer, cured on the wire that is zinc-coated by the electrolytic process, or aluminum-coated by the hot-dip method.

- c. RAZOR RIBBON:

1. Security Toppings Barbed Tape Obstacles.
 - a. BTO shall be fabricated from AISI T430 stainless steel, U.S. Federal Specification Number QQS766C hardened to RC 20-24. The stainless steel strip shall be fabricated from material .025 inches thick, 1 inch wide with clusters of 4 barbs cut on 4 inch centers. Each barb shall be 1.200 inches minimum in length and needle sharp. Barb shall be measured from center of barb cluster to point of barb.
 - b. Stainless steel barbed tape will be permanently cold clenched over a spring steel wire having a minimum tensile strength of 220,000 psi and a diameter of .098 inches minimum. This center core wire shall be hot-dipped zinc galvanized with a zinc weight of .8 ounces per square foot of surface.
 - c. Breakload - to withstand minimum breakload of 1500 pounds.
 - d. Attachment Spacings - BTO helical security topping shall be installed on 18 inch centers for standard commercial fencing, 9 inch centers on heavy commercial and heavy industrial fences. BTO shall be installed on 6 inch centers for correctional fencing.
 - e. Finish - Bright finish shall have a 20 degree spectral gloss reading greater than 30 per method 6104 of Federal test method standard 141A.
 - f. Double Coil Barbed Tape Obstacle - Double coil Barbed Tape Obstacle shall be

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

fabricated from a 24" diameter coil within a 30" diameter coil.

Adjacent loops of each coil shall be clipped together in three (3) locations around the circumference to produce the concertina effect upon deployment. Each coil shall consist of 31 loops with the spacing between attachment points equal to 16" ± 2". Clips shall be fabricated from stainless steel. Clip dimensions are .065" x .375". Clips shall be capable of withstanding a minimum pull load of 100#. Barbed Tape shall be fabricated from 430 stainless steel hardened to Rockwell (30N) 40-45. Barbed Tape shall be permanently cold-clenched around a .098" diameter Class 3 Galvanized steel reinforcing wire. Barbed Tape shall have a minimum 230 wrap around the core wire. The core wire shall have a tensile strength of 220,000 psi. The stainless trip shall be one inch wide by .025" thick with clusters of four (4) needle-sharp barbs on 4" centers. Barbs shall have a minimum length of 1.2". The length of the extended coil shall be 20'.

d. RAZOR RIBBON SUPPORTS:

1. Supports: Combination post top and V-shape extension arm device support razor ribbon. Supports shall be of galvanized steel or malleable iron. Provide vertical type supports as noted or required. Supports shall be fitted with clips or other devices to secure razor ribbon.

e. GATES:

1. Provide framework and accessories as recommended by fence manufacturer for type and size of gate required, and in accordance with industry standards for such assemblies.
2. Chain-link fabric on gates shall be same as specified for fence system.
3. Include all reinforcements necessary to accommodate gate hardware.
4. Gate Types and Hardware:
 - a. For Swinging Gates: Include latching devices, stops, locks and 1 ½ pair of non-lift off type hinges, offset to permit 180 degree gate opening. Provide key-operated locking device for each swinging gate with key cylinder both sides of lock. Lock shall be type to receive mortise-type cylinder and shall be provided less cylinders. (Key cylinders are to be provided under "Finish Hardware" Section - Division 8). All hardware shall be of type to satisfactorily withstand exterior weather exposure.
 - b. Cantilever Gate Systems using Hy-Security Model 222-SS with Internal Electric Lock: The gate systems will be "V" track. The track will be installed as part of new roadway and recessed to grade. The "V" wheels (3) will be 4 inch sealed bearing rated at 1,000 LB each. They will be installed such that the gate panel is within 5 inches of grade. The track will be twice the width of opening. There will be a latch device on the closed end that will be of cantilever type. They will be doubled sealed bearings designed for 4 inch support post and 2 ½ inch round pipe.

The gate panel will have 2 ½ inch top and bottom pipe schedule 40 galvanized. All other members will be 2 inch schedule 40 pipe. The fabric will match adjoining fence in weight, style, height, and will be welded to the top and bottom rail. All joints will be welded, cleaned, ground smooth, and painted with cold galvanize.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

Fence ties will be steel of same strength as the fabric. Support and latch post will be 4 inch schedule 40. The gate panel length will be equal to the width of the opening plus 5 feet. There will be 3 feet and 6 inches between the support post.

Gate Operator will be Hy-Security Model 222-SS with internal electric lock.

- f. FITTINGS AND ACCESSORIES: As recommended by fence manufacturer for installation of fence component EXCEPT as otherwise noted herein. All components shall be galvanized steel, wrought iron or malleable iron as required unless otherwise noted.
 - 1. NOTE: Furnish U-bolt clamps for securing fence fabric to fence framework (line posts, horizontal rails and gate frames) in lieu of wire ties. U-bolts shall be 1/4" diameter with threaded ends and nuts to retain a 1/8" thick clamp plate across open end of U-bolt.
- g. CONCRETE: Provide minimum 3,000 psi strength concrete for use in setting fence posts.
- h. Non-climbable galvanized fence fabric. Base bid at areas where shown on drawings:
 - 1. Mini Mesh Chain Link Fabric in heights as indicated on Mini Mesh drawing woven from 11 gauge wire in 3/8" diamond mesh pattern. Mini Mesh Chain Link shall be of high grade commercial quality with a minimum breaking strength of 850 pounds. Fabric and coating meeting the requirements of ASTM F668, zinc-coated by the electrolytic process, or aluminum-coated by the hot-dip method.

1.07 EXECUTION:

- a. Examine conditions under which the work is to be installed. Report unsatisfactory conditions, if any, and do not proceed until unsatisfactory conditions are corrected.
- b. Lay out work accurately and verify proper grade elevations.
- c. Coordinate proper installation of gate hardware.

1.08 INSTALLATION (Meet requirements of ASTM F567)

- a. Fabricate and install all fence work per approved shop drawings, manufacturer's recommendations and as specified.
- b. Clear path of fence line of all obstructions and grade surface irregularities where necessary so that fence will conform to the general contour of the ground as indicated. Keep opening between bottom of fence and ground to a minimum required for installation.
- c. Height of fence, as indicated on drawings, means fabric height unless specifically noted of detailed otherwise. Provide all posts in lengths to extend minimum 3'-0" below finished grade.
- d. Space all posts as recommended by manufacturer for fence height involved, but not more than 10'-0" on centers. Space posts symmetrically in each run if not otherwise noted. Set all posts in holes minimum 12" diameter and minimum 42" deep (below finish grade) and fill with concrete. Trowel finish top of concrete base and slope for drainage away from post.
- e. Install fence work including bracing, rails, fittings, razor ribbon hardware, etc., as required

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

for a complete and rigid installation. Stretch fabric taut between supports and attach securely. Fence and gates shall be installed plumb and true. Fabric shall be installed on side of framework as indicated on drawings.

1. Secure fence fabric to framework (line posts, horizontal rails and gate frames) using U-bolt clamps specified hereinbefore at intervals not exceeding 15". Wire ties will not be permitted in lieu of the U-bolt clamps. After installation of U-bolt clamps and after nuts are tightened, tack weld nuts to the bolt.
 2. After installation of tension bands used in conjunction with terminal posts and stretcher bars, tack weld nut of bolt fastener to the bolt. Tension bands shall be installed at intervals not exceeding 15".
- f. Install gates as required for proper operation. Install support, and equipment in accordance with approved shop drawings and manufacturer's instructions.

1.09 CHECKING AND ADJUSTMENTS:

- a. Check out all fence/gate operations for proper operation. Adjust and lubricate as required for smooth operation.

END OF SECTION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Reinforcing bars.
 - 2. Welded wire fabric.
 - 3. Reinforcement accessories.
- B. Related Sections:
 - 1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 301 - Specifications for Structural Concrete.
 - 2. ACI 318 - Building Code Requirements for Structural Concrete.
 - 3. ACI SP-66 - ACI Detailing Manual.
- B. ASTM International:
 - 1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - 2. ASTM A184/A184M - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
 - 3. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
 - 4. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - 5. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 - 6. ASTM A704/A704M - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
 - 7. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
 - 8. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
 - 9. ASTM A775/A775M - Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
 - 10. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement.
 - 11. ASTM A934/A934M - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
 - 12. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
 - 13. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Reinforcing Steel Bars.
- C. American Welding Society:
 - 1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- D. Concrete Reinforcing Steel Institute:
 - 1. CRSI - Manual of Standard Practice.
 - 2. CRSI - Placing Reinforcing Bars.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures.
- B. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and welded wire fabric, bending and cutting schedules.
- C. Certificates: Submit AWS qualification certificate for welders employed on the Work.
- D. Submit certified copies of mill test report of reinforcement materials analysis.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with CRSI - Manual of Standard Practice and ACI 301.

1.5 QUALIFICATIONS

- A. Welders: AWS qualified within previous 12 months.

1.6 COORDINATION

- A. Section 01 30 00 - Administrative Requirements.
- B. Coordinate with placement of formwork, formed openings and other Work.

PART 2 PRODUCTS

2.1 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615/A615M, 60 ksi yield grade; deformed billet steel bars, unfinished.
- B. Reinforcing Steel Plain Bar and Rod Mats: ASTM A704/A704M, ASTM A615/A615M, Grade 60; steel bars or rods, unfinished.
- C. Stirrups Steel: ASTM A82, unfinished.
- D. Welded Steel Wire Fabric: ASTM A497 Deformed Type; in flat sheets or coiled rolls; galvanized finish.

2.2 ACCESSORY MATERIALS

- A. Tie Wire: Minimum 16 gage annealed type.
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor retarder puncture.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic tipped steel type; size and shape to meet Project conditions.
- D. Reinforcing Splicing Devices: Exothermic welding type; full tension and compression; sized to fit joined reinforcing.

2.3 FABRICATION

- A. Fabricate concrete reinforcement in accordance with CRSI Manual of Practice.

PART 3 EXECUTION

3.1 PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
- B. Do not displace or damage vapor retarder.
- C. Accommodate placement of formed openings.
- D. Maintain concrete cover around reinforcement as follows:

<u>Item</u>	<u>Coverage</u>
Concrete in contact with soil	3 inches
Exterior concrete	
Bars larger than No. 5	2 inches
No. 5 bars and smaller	1-1/2 inches
Interior concrete	
Bars larger than No. 11	1-1/2 inches
No. 11 bars and smaller	3/4 inch
Stirrups	1-1/2 inches

- E. Conform to applicable code for all other conditions.
- F. Splice reinforcing in accordance with splicing device manufacturer's instructions.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

G. Lap length shall be as follows unless otherwise noted on the Drawings:

<u>Bar Size</u>	<u>Lap Length</u>
No. 3	12 inches
No. 4	12 inches
No. 5	15 inches
No. 6	18 inches
No. 7	24 inches
No. 8	30 inches

3.2 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements; Section 01 70 00 - Execution Requirements.

END OF SECTION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 3 CONCRETE
Section 03 30 00 Cast In Place Concrete

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes :
 - 1. Cast-in-place concrete.
 - 2. Formwork.
 - 3. Reinforcing.
 - 4. Mix Design.
 - 5. Control, expansion and contraction joint devices.
 - 6. Placement procedures.
 - 7. Finishes.
 - 8. Testing requirements.

- B. Related Documents:
 - 1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 301 - Specifications for Structural Concrete.
 - 2. ACI 305 - Hot Weather Concreting.
 - 3. ACI 306.1 - Standard Specification for Cold Weather Concreting.
 - 4. ACI 318 - Building Code Requirements for Structural Concrete.

- B. ASTM International:
 - 1. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 2. ASTM C33 - Standard Specification for Concrete Aggregates.
 - 3. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
 - 4. ASTM C150 - Standard Specification for Portland Cement.
 - 5. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
 - 6. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
 - 7. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
 - 8. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
 - 9. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
 - 10. ASTM C1017 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 - 11. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
 - 12. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
 - 13. ASTM D994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
 - 14. ASTM D1190 - Standard Specification for Concrete Joint Sealer, Hot-Applied

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- 15. Elastic Type.
ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- 16. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
- 17. ASTM E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
- 18. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.3 SUBMITTALS

- A. Section 01330 - Submittal Procedures.
- B. Product Data: Submit data on joint devices, attachment accessories, and admixtures.
- C. Design Data:
 - 1. Submit concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following:
 - a. Hot and cold weather concrete work.
 - b. Air entrained concrete work.
 - 2. Identify mix ingredients and proportions, including admixtures.
- D. Manufacturer's Installation Instructions: Submit installation procedures and interface required with adjacent Work.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01700 - Execution Requirements.
- B. Project Record Documents: Accurately record actual locations of embedded utilities and components concealed from view in finished construction.

1.5 QUALITY CONTROL / QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301.
- B. Maintain one copy of each document on site.
- C. Acquire cement and aggregate from one source for Work.
- D. Conform to ACI 305 when concreting during hot weather.
- E. Conform to ACI 306.1 when concreting during cold weather.
- F. Concrete Testing Service: Owner will provide quality assurance testing during construction. Contractor is responsible to provide suitable quality control of materials, procedures, and of the mix design process to ensure the concrete conforms to the project plans and specifications. Submit quality control plan and proposed concrete mix designs to Engineer prior to concrete placement.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1.6 COORDINATION

- A. Section 01300 - Administrative Requirements.
- B. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 PRODUCTS

2.1 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces.
 - 1. Use overlaid plywood complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete Form", Class 1.
 - 2. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class 1, Exterior Grade or better, mill-oiled and edge sealed, with each piece bearing legible inspection trademark.
- B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least 2 edges and one side for a tight fit.
- C. Form Coatings: Provide commercial formulation form coating compounds with a maximum VOC of 350 mg/l that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
- D. Form Ties: Factory fabricated, adjustable length, removable or snap-off metal form ties, designed to prevent form deflection and to prevent spalling concrete upon removal.

2.2 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A615, Grade 60, deformed.
- B. Welded Wire Fabric: ASTM A185 welded steel wire fabric.
- C. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire-bar type supports complying with CRSI specifications.
 - 1. For slabs-on-grade use supports with sand plates or horizontal runners where base material will not support chair legs.
 - 2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs that are plastic protected (CRSI, class 1) or stainless steel protected (CRSI, class 2).
 - 3. For sand blasted or intentionally roughened concrete surfaces, provide supports of stainless steel (CRSI, class 2).
- D. Reinforcing Bars to be Welded: ASTM A706, "Specifications for Low Alloy Steel Deformed Bars for Concrete Reinforcement".
- E. Bar and Rod Mats: ASTM A184 "Specifications for Fabricated Deformed Steel Bar

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

Mats for Concrete Reinforcement”.

- F. Threaded Dowels: Continuous Threaded high-strength steel bars. Provide inserts compatible with dowels, designed for ultimate pull-out force indicated on the Drawings.
- G. Mechanical Splices: Equal to “Cadweld Rebar Splices”, as manufactured by Erico Products, Inc., “C” Series, for developing 125% of minimum ASTM specified yield strengths, unless otherwise noted on Drawings.
- H. Steel Shapes, Plates and Rods: Conform to ASTM A36 “Specifications for Structural Steel”.
- I. Do not weld reinforcing steel unless specifically noted on Drawings. If welding is shown, conform to latest revision of AWS D12.1, “Reinforcing Steel Welding Code of the American Welding Society”. Perform all welding with certified welders qualified per AWS.

2.3 CONCRETE MATERIALS

- A. Cement: ASTM C150, Type I – Normal, Portland type for all applications other than structures used in conjunction with wastewater projects. All wastewater related structures shall use Type V – Sulfate Resistant, Portland Cement.
- B. Fly Ash: ASTM C618, Type C or Type F.
 - 1. Limit use of fly ash to not exceed 20 percent of cement content by weight.
- C. Normal Weight Aggregate: ASTM C33 and as herein specified. Provide aggregates from a single source for exposed concrete.
 - 1. For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling-causing deleterious substances.
- D. Water: Clean, potable.
- E. Admixtures, General: Provide admixtures for concrete that contain not more than 0.1 percent chloride ions.
- F. Air-Entraining Admixtures: ASTM C260, certified by manufacturer to be compatible with other required admixtures.
- G. Water Reducing Admixtures: ASTM C494, Type A.
- H. High Range Water Reducing Admixtures (Super Plasticizer): ASTM C494, Type F or Type G.
- I. Water Reducing, Non-Chloride Accelerating Admixture: ASTM C494, Type E.
- J. Water Reducing, Retarding Admixture: ASTM C494, Type D.
- K. All admixtures shall be supplied by the same manufacturer.

2.4 ACCESSORIES

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Vapor Retarder: ASTM E1745 Class A; 6 mil thick fabric-reinforced plastic film, 0.03 perms; rated for below grade application. Furnish joint tape recommended by manufacturer.
- B. Non-Shrink Grout: ASTM C1107, premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.
- C. Concrete Reinforcing Fibers: ASTM C1116, high strength industrial-grade fibers specifically engineered for secondary reinforcement of concrete. Tensile strength 130 ksi; toughness 15 ksi; 3/4 inch long fibers, 34 million/lb fiber count.
- D. Waterstops: Provide flat, dumbbell-type or centerbulb-type waterstops at construction joints and other joints as shown on the Drawings.
- E. Granular Base: Evenly graded mixture of fine and course aggregates to provide, when compacted, a smooth and even surface below slabs on grade.
- F. Sand Cushion: Clean, manufactured or natural sand.
- G. Nonslip Aggregate Finish: Provide fused aluminum oxide granules or crushed emery as abrasive aggregate for nonslip finish. Material shall be factory graded, rustproof, non-glazing, and is unaffected by freezing, moisture, and cleaning materials.
- H. Colored Wear Resistant Finish: Packaged, dry, combination of materials consisting of Portland cement, graded quartz aggregate, coloring pigments, and plasticizing admixture. Use coloring pigments that are finely ground, nonfading mineral oxides, interground with cement. Color as selected by Engineer.
- I. Bonding Compound: Polyvinyl acetate or acrylic base.
- J. Epoxy Adhesive: ASTM C881, two-component material suitable on dry or damp surfaces. Provide material type, grade and class to suit project requirements.

2.5 JOINT DEVICES AND FILLER MATERIALS

- A. Joint Filler Type A: ASTM D994; Asphalt impregnated fiberboard or felt, 1/2 inch thick; tongue and groove profile.
- B. Joint Filler Type B: ASTM D1752; Closed cell polyvinyl chloride foam, resiliency recovery of 95 percent if not compressed more than 50 percent of original thickness.
- C. Construction Joint Devices: Integral galvanized steel, formed to tongue and groove profile, with removable top strip exposing sealant trough, knockout holes spaced at 6 inches, ribbed steel spikes with tongue to fit top screed edge.
- D. Expansion and Contraction Joint Devices: ASTM B221 alloy, extruded aluminum; resilient neoprene filler strip with Shore A hardness of 35 to permit plus or minus 25 percent joint movement with full recovery; extruded aluminum of longest manufactured length at each location, flush mounted.

2.6 CONCRETE MIX

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Mix concrete in accordance with ACI 301. Deliver concrete in accordance with ASTM C94.
- B. Select proportions for normal weight concrete in accordance with ACI 301 trial mixtures.
- C. Prepare design mixes for each type and strength of concrete by either laboratory trial mixture or field experience methods as specified in ACI 318-89 Section 5.3.
- D. Mix design based on historical performances in accordance with ACI 318-89 Section 5.3, may be provided by a qualified concrete supplier or precast concrete manufacturer for concrete designs. Mix design shall be certified by an independent testing laboratory.
- E. All concrete mix designs shall include the following information:
 - 1. Proportions of cement, fine and coarse aggregates and water.
 - 2. Water/cement ratio, design strength, slump and air content.
 - 3. Type and source of cement and aggregates.
 - 4. Type and dosage of all admixtures.
 - 5. Any special characteristics of the mix which require precautions in the mixing, placing or finishing techniques to achieve the finished product specified.
- F. Engineer to review and approve mix designs prior to start of concrete production.
- G. Design mixes to provide normal weight concrete.
- H. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Engineer.
- I. All mix design information and data shall not be older than 18 months from the date of the submittal.

2.7 ADMIXTURES

- A. Use water reducing admixture or high range water reducing admixture (superplasticizer) in concrete as required for placement and workability.
- B. Use high range water reducing admixture in pumped concrete, concrete required to be watertight, and concrete with water/cement ratio below 0.50.
- C. Use nonchloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 degrees F.
- D. Use air-entraining admixture in concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete having an air content of 4% to 6% at the point of placement.
- E. Use admixtures for water reduction and set control in strict compliance with manufacturer's directions.
- F. Temperature Limit: Do not place concrete if the concrete temperature exceeds 90°F or the ambient temperature is 40°F or less and falling.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- G. Slump Limit: Proportion and design mixes to result in concrete slump of 3 to 5 inches at point of placement.

2.8 CONCRETE MIXING

- A. Provide batch ticket for each batch used on the project. Batch ticket must indicate project name, contractor's name, date, mix type, mix time, batch time, quantity, and amount of water introduced.
- B. Ready-Mix Concrete: Comply with requirements of ASTM C94, and as specified.
 - 1. Addition of water to batch for material with insufficient slump will be permitted in accordance with ACI 301.
 - 2. When air temperature is between 85 degrees F. and 90 degrees F., reduce mixing and delivery time from 1-1/2 hours to 75 minutes. When air temperature exceeds 90 degrees F. reduce mixing and delivery time to 60 minutes.
 - 3. Concrete shall only be placed when the air temperature is above 40 degrees F. and rising.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements.
- B. Verify requirements for concrete cover over reinforcement.
- C. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.2 FORMS

- A. General: Design, erect, support, brace, and maintain formwork to support vertical and lateral, static and dynamic loads that might be applied until concrete structure can support such loads.
- B. Maintain formwork construction tolerances complying with ACI 301 Table 4.3.1.
- C. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, chamfers, blocking, bulkheads, anchorages, and other features required in work.
- D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces.
- E. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar.
- F. Chamfer exposed edges and corners as indicated using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- G. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items.
- H. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed.

3.3 VAPOR BARRIER

- A. General: Following leveling and tamping of granular base for slabs-on-grade, place vapor barrier sheeting with longest dimension parallel with direction of pour.
- B. Lap joints 6 inches and seal vapor barrier joints with manufacturer's recommended mastic and pressure-sensitive tape.
- C. After placement of vapor barrier, cover with sand cushion and compact to depth as shown on Drawings.

3.4 PLACING REINFORCEMENT

- A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as herein specified.
 - 1. Avoiding cutting or puncturing vapor retarder during reinforcement placement and concreting operations.
- B. Clean reinforcement of loose rust and mill scale, earth ice, and other materials that reduce or destroy bond with concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
- D. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 JOINTS

- A. Construction Joints: Locate and install construction joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure.
- B. Provide keyways at least 1-1/2 inches deep in construction joints in walls, slabs, beams and between walls and footings.
- C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as otherwise indicated.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- E. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Field-fabricate joints in waterstops in accordance with manufacturer's printed instructions.
- F. Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs-on-ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.
- G. Contraction (Control) Joints in Slabs-On-Grade: Construct contraction joints in slabs-on-ground to form panels of patterns as shown. Use saw cuts 1/8 inch wide by 1/3 slab depth or approved inserts, unless otherwise indicated. Make saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregates.
 - 1. With prior approval from Engineer contraction joints may be formed by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.
 - 2. Refer to drawings for scoring pattern as shown. If joint pattern not shown, provide joints not exceeding 15 feet in either direction and located to conform to bay spacing wherever possible.

3.6 PREPARATION OF FORM SURFACES

- A. Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.
- B. Coat contact surfaces of forms with an approved, noresidual, low-VOC, form-coating compound before reinforcement is placed. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.
- C. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.7 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in.
- B. General: Comply with ACI 304, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete."
- C. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete to avoid segregation at its final location.
- D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- cold joints.
- E. Consolidate full depth of placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.
 - F. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
 - G. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
 - 1. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or derbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations
 - 3. Maintain reinforcing in proper position during concrete placement.
 - H. Cold-Weather Placing: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When placing concrete in cold weather, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
 - 2. Concrete shall only be placed when the air temperature is above 40 degrees F. and rising.
 - 3. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 4. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
 - I. Hot-Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI305 and as herein specified.
 - 1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F (32 deg C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.
 - 2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
 - 3. Fog spray forms, reinforcing steel, and subgrade just before concrete is placed.
 - 4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, when acceptable to Engineer.

3.8 FINISH OF FORMED SURFACES

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Rough Form Finish: For formed concrete surfaces not exposed to view in the finish work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.
- B. Smooth Form Finish: For formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or other similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.
- C. Smooth Rubbed Finish: Provide smooth rubbed finish to scheduled concrete surfaced, which have received smooth form finish treatment, not later than one day after form removal.
 - 1. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.
- D. Grout-Cleaned Finish: Provide grout-cleaned finish to scheduled concrete surfaces that have received smooth form finish treatment.
 - 1. Combine one part Portland cement to 1-1/2 parts fine sand by volume, and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water to consistency of thick paint. Blend standard Portland cement and white Portland cement, amount determined by trial patches, so that final color of dry grout will match adjacent surfaces.
 - 2. Thoroughly wet concrete surfaces, apply grout to coat surfaces, and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.
- E. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.
- F. Unless otherwise noted on the Drawings, all exposed surfaces shall receive a smooth rubbed finish.

3.9 SLAB FINISHES

- A. After placing slabs, plane surface to tolerances for floor flatness (Ff) of 15 and floor levelness (Fl) of 13. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushed, brooms, or rakes, as required.
- B. Float Finish: Apply float finish to slab surfaces to receive trowel finish and other finishes as hereinafter specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo; and as otherwise indicated.
 - 1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

driven floats or by hand floating if area is small or inaccessibly to power units. Check and level surface plane to tolerances of Ff 18-FI 15. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

- C. Trowel Finish: Apply trowel finish to slab surfaces to be exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system.
 - 1. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of Ff 20-FI 17. Grind smooth surface defects that would telegraph through applied floor covering system.
- D. Nonslip Broom Finish: Apply nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.
- E. Nonslip Aggregate Finish: Apply nonslip aggregate finish to concrete stair treads, platforms, ramps, sloped walks, and elsewhere as indicated.
- F. After completion of float finishing and before starting trowel finish, uniformly spread 25 lbs. of dampened nonslip aggregate per 100 sq. ft. of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as herein specified.
- G. After curing, lightly work surface with a steel wire brush, or an abrasive stone, and water to expose nonslip aggregate.

3.10 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply in accordance with manufacturer's instructions after screeding and bull floating, but before power floating and troweling.
- B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting; keep continuously moist for not less than 7 days.
- C. Curing Methods: Perform curing of concrete by curing and sealing compound, moist curing, by moisture-retaining cover curing, and by combinations thereof, as herein specified.
- D. Provide moisture curing by following methods.
 - 1. Keep concrete surface continuously wet by covering with water.
 - 2. Use continuous water-fog spray.
 - 3. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide

coverage of concrete surfaces and edges, with 4-inch lap over adjacent absorptive covers.

3.11 REMOVAL OF FORMS

- A. General: Formwork not supporting weight of concrete, such as sides of beams, walls columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.
- B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed until approved by the structural engineer.
- C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

3.12 CONCRETE SURFACE REPAIRS

- A. General: No surface shall be patched or repaired until the Engineer had reviewed the defective condition and approved the Contractor's submitted repair and/or patching materials and procedures.
- B. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Engineer.
 - 1. Cut of honeycomb, rock pockets, and voids over 1/4 inch in any dimension, and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. Place patching mortar before bonding compound has dried.
 - 2. For exposed-to-view surfaces, blend white portland cement and standard portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
- C. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Engineer. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry-pack mortar, or precast cement cone plugs secured in place with bonding agent.
 - 1. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.
- D. Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having required slope.
 - 1. Repair finished unformed surfaces that contain defects that affect durability of

concrete. Surface defects, as such, include crazing and cracks in excess of 0.01 in wide or that penetrate to reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets, and other objectionable conditions.

2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
 3. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with patching compound. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Engineer.
 4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, when acceptable to Engineer by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
- E. Repair isolated random cracks and single holes not over 1 inch in diameter by dry-pack method when acceptable to Engineer. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.
- F. Perform structural repairs with prior approval of Structural Engineer for method and procedure, using specified epoxy adhesive and mortar.
- G. Repair methods not specified above may be used, subject to acceptance of Engineer.

3.13 FIELD QUALITY ASSURANCE, CONTROL AND TESTING DURING CONSTRUCTION

- A. General: The Owner will employ CDG Engineers and Associates to perform the required quality assurance testing during construction. The Contractor will notify the Engineer at least 24 hours prior to requiring tests. The Contractor is responsible to provide equipment to allow sampling and testing of the concrete at the point of placement.
- B. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94. Perform the following tests.
1. Slump: ASTM C 143; one test at point of placement for each set of compression test specimens; additional tests when concrete properties appear to have changed.
 2. Air Content: ASTM C 173 (volumetric method for lightweight or normal weight concrete) or ASTM C 231 (pressure method for normal weight concrete); one test at point of placement for each set of compression test specimens; additional tests when concrete properties appear to have changed.
 3. Concrete Temperature: ASTM C 1064; test hourly when air temperature is 40°F and below or 80°F and above, and each time a set of compression test specimens is made.
 4. Compression Test Specimen: ASTM C 31; one set of 4 cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cure test specimens are required.
 5. Compressive Strength Tests: ASTM C 39; one set for each 50 cubic yards or

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

fraction thereof for each concrete class placed in any one day. One specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing, if required.

6. When frequency of testing will provide fewer than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
- C. Test results will be reported in writing to Engineer, Ready-Mix Producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete supplier and testing agency, concrete type and class, location of concrete placed in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.
- D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but **shall not** be used as the sole basis for acceptance or rejection.
- E. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Engineer. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.
- F. Quality Assurance consisting of testing and observation of a limited sampling of construction materials will be provided by the Owner for acceptance purposes. Passing test results are not a warranty, guarantee, or certification by the testing agency, Engineer, or Owner that all work was performed in conformance with the plans and specifications. Therefore, the Contractor should not rely solely on test results generated by the quality assurance process as an indication of the suitability of the construction.
- G. It is entirely the Contractor's responsibility to perform quality control as necessary to construct the project in conformance with the plans and specifications. Deviations from the plans and specifications, whether identified during construction or following the completion of construction, must be corrected by the Contractor at no cost to the Owner.

3.14 DEFECTIVE CONCRETE

- A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- B. Repair or replacement of defective concrete will be determined by Engineer.
- C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

END OF SECTION
03 30 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 3 CONCRETE
Section 03 30 00 Cast In Place Concrete

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes :
 - 1. Cast-in-place concrete.
 - 2. Formwork.
 - 3. Reinforcing.
 - 4. Mix Design.
 - 5. Control, expansion and contraction joint devices.
 - 6. Placement procedures.
 - 7. Finishes.
 - 8. Testing requirements.

- B. Related Documents:
 - 1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 301 - Specifications for Structural Concrete.
 - 2. ACI 305 - Hot Weather Concreting.
 - 3. ACI 306.1 - Standard Specification for Cold Weather Concreting.
 - 4. ACI 318 - Building Code Requirements for Structural Concrete.

- B. ASTM International:
 - 1. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 2. ASTM C33 - Standard Specification for Concrete Aggregates.
 - 3. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
 - 4. ASTM C150 - Standard Specification for Portland Cement.
 - 5. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
 - 6. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
 - 7. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
 - 8. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
 - 9. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
 - 10. ASTM C1017 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 - 11. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
 - 12. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
 - 13. ASTM D994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
 - 14. ASTM D1190 - Standard Specification for Concrete Joint Sealer, Hot-Applied

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- 15. Elastic Type.
ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- 16. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
- 17. ASTM E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
- 18. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.3 SUBMITTALS

- A. Section 01330 - Submittal Procedures.
- B. Product Data: Submit data on joint devices, attachment accessories, and admixtures.
- C. Design Data:
 - 1. Submit concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following:
 - a. Hot and cold weather concrete work.
 - b. Air entrained concrete work.
 - 2. Identify mix ingredients and proportions, including admixtures.
- D. Manufacturer's Installation Instructions: Submit installation procedures and interface required with adjacent Work.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01700 - Execution Requirements.
- B. Project Record Documents: Accurately record actual locations of embedded utilities and components concealed from view in finished construction.

1.5 QUALITY CONTROL / QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301.
- B. Maintain one copy of each document on site.
- C. Acquire cement and aggregate from one source for Work.
- D. Conform to ACI 305 when concreting during hot weather.
- E. Conform to ACI 306.1 when concreting during cold weather.
- F. Concrete Testing Service: Owner will provide quality assurance testing during construction. Contractor is responsible to provide suitable quality control of materials, procedures, and of the mix design process to ensure the concrete conforms to the project plans and specifications. Submit quality control plan and proposed concrete mix designs to Engineer prior to concrete placement.

1.6 COORDINATION

- A. Section 01300 - Administrative Requirements.
- B. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 PRODUCTS

2.1 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces.
 - 1. Use overlaid plywood complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete Form", Class 1.
 - 2. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class 1, Exterior Grade or better, mill-oiled and edge sealed, with each piece bearing legible inspection trademark.
- B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least 2 edges and one side for a tight fit.
- C. Form Coatings: Provide commercial formulation form coating compounds with a maximum VOC of 350 mg/l that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
- D. Form Ties: Factory fabricated, adjustable length, removable or snap-off metal form ties, designed to prevent form deflection and to prevent spalling concrete upon removal.

2.2 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A615, Grade 60, deformed.
- B. Welded Wire Fabric: ASTM A185 welded steel wire fabric.
- C. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire-bar type supports complying with CRSI specifications.
 - 1. For slabs-on-grade use supports with sand plates or horizontal runners where base material will not support chair legs.
 - 2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs that are plastic protected (CRSI, class 1) or stainless steel protected (CRSI, class 2).
 - 3. For sand blasted or intentionally roughened concrete surfaces, provide supports of stainless steel (CRSI, class 2).
- D. Reinforcing Bars to be Welded: ASTM A706, "Specifications for Low Alloy Steel Deformed Bars for Concrete Reinforcement".
- E. Bar and Rod Mats: ASTM A184 "Specifications for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement".

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- F. Threaded Dowels: Continuous Threaded high-strength steel bars. Provide inserts compatible with dowels, designed for ultimate pull-out force indicated on the Drawings.
- G. Mechanical Splices: Equal to "Cadweld Rebar Splices", as manufactured by Erico Products, Inc., "C" Series, for developing 125% of minimum ASTM specified yield strengths, unless otherwise noted on Drawings.
- H. Steel Shapes, Plates and Rods: Conform to ASTM A36 "Specifications for Structural Steel".
- I. Do not weld reinforcing steel unless specifically noted on Drawings. If welding is shown, conform to latest revision of AWS D12.1, "Reinforcing Steel Welding Code of the American Welding Society". Perform all welding with certified welders qualified per AWS.

2.3 CONCRETE MATERIALS

- A. Cement: ASTM C150, Type I – Normal, Portland type for all applications other than structures used in conjunction with wastewater projects. All wastewater related structures shall use Type V – Sulfate Resistant, Portland Cement.
- B. Fly Ash: ASTM C618, Type C or Type F.
 - 1. Limit use of fly ash to not exceed 20 percent of cement content by weight.
- C. Normal Weight Aggregate: ASTM C33 and as herein specified. Provide aggregates from a single source for exposed concrete.
 - 1. For exterior exposed surfaces, do not use fine or course aggregates containing spalling-causing deleterious substances.
- D. Water: Clean, potable.
- E. Admixtures, General: Provide admixtures for concrete that contain not more than 0.1 percent chloride ions.
- F. Air-Entraining Admixtures: ASTM C260, certified by manufacturer to be compatible with other required admixtures.
- G. Water Reducing Admixtures: ASTM C494, Type A.
- H. High Range Water Reducing Admixtures (Super Plasticizer): ASTM C494, Type F or Type G.
- I. Water Reducing, Non-Chloride Accelerating Admixture: ASTM C494, Type E.
- J. Water Reducing, Retarding Admixture: ASTM C494, Type D.
- K. All admixtures shall be supplied by the same manufacturer.

2.4 ACCESSORIES

- A. Vapor Retarder: ASTM E1745 Class A; 6 mil thick fabric-reinforced plastic film, 0.03 perms; rated for below grade application. Furnish joint tape recommended by

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

manufacturer.

- B. Non-Shrink Grout: ASTM C1107, premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.
- C. Concrete Reinforcing Fibers: ASTM C1116, high strength industrial-grade fibers specifically engineered for secondary reinforcement of concrete. Tensile strength 130 ksi; toughness 15 ksi; 3/4 inch long fibers, 34 million/lb fiber count.
- D. Waterstops: Provide flat, dumbbell-type or centerbulb-type waterstops at construction joints and other joints as shown on the Drawings.
- E. Granular Base: Evenly graded mixture of fine and course aggregates to provide, when compacted, a smooth and even surface below slabs on grade.
- F. Sand Cushion: Clean, manufactured or natural sand.
- G. Nonslip Aggregate Finish: Provide fused aluminum oxide granules or crushed emery as abrasive aggregate for nonslip finish. Material shall be factory graded, rustproof, non-glazing, and is unaffected by freezing, moisture, and cleaning materials.
- H. Colored Wear Resistant Finish: Packaged, dry, combination of materials consisting of Portland cement, graded quartz aggregate, coloring pigments, and plasticizing admixture. Use coloring pigments that are finely ground, nonfading mineral oxides, interground with cement. Color as selected by Engineer.
- I. Bonding Compound: Polyvinyl acetate or acrylic base.
- J. Epoxy Adhesive: ASTM C881, two-component material suitable on dry or damp surfaces. Provide material type, grade and class to suit project requirements.

2.5 JOINT DEVICES AND FILLER MATERIALS

- A. Joint Filler Type A: ASTM D994; Asphalt impregnated fiberboard or felt, 1/2 inch thick; tongue and groove profile.
- B. Joint Filler Type B: ASTM D1752; Closed cell polyvinyl chloride foam, resiliency recovery of 95 percent if not compressed more than 50 percent of original thickness.
- C. Construction Joint Devices: Integral galvanized steel, formed to tongue and groove profile, with removable top strip exposing sealant trough, knockout holes spaced at 6 inches, ribbed steel spikes with tongue to fit top screed edge.
- D. Expansion and Contraction Joint Devices: ASTM B221 alloy, extruded aluminum; resilient neoprene filler strip with Shore A hardness of 35 to permit plus or minus 25 percent joint movement with full recovery; extruded aluminum of longest manufactured length at each location, flush mounted.

2.6 CONCRETE MIX

- A. Mix concrete in accordance with ACI 301. Deliver concrete in accordance with ASTM C94.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
 MENTAL HEALTH / MEDICAL UNIT
 ANNISTON, ALABAMA

- B. Select proportions for normal weight concrete in accordance with ACI 301 trial mixtures.
- C. Provide concrete to the following criteria:

Unit	Measurement
Compressive Strength (f'c at 28 day)	4,000 pounds per square inch
Aggregate Size (maximum)	1 inch
Air Entrainment	4 to 6 percent
Slump	3 to 5 inches

- D. Prepare design mixes for each type and strength of concrete by either laboratory trial mixture or field experience methods as specified in ACI 318-89 Section 5.3.
- E. Mix design based on historical performances in accordance with ACI 318-89 Section 5.3, may be provided by a qualified concrete supplier or precast concrete manufacturer for concrete designs. Mix design shall be certified by an independent testing laboratory.
- F. All concrete mix designs shall include the following information:
 1. Proportions of cement, fine and coarse aggregates and water.
 2. Water/cement ratio, design strength, slump and air content.
 3. Type and source of cement and aggregates.
 4. Type and dosage of all admixtures.
 5. Any special characteristics of the mix which require precautions in the mixing, placing or finishing techniques to achieve the finished product specified.
- G. Engineer to review and approve mix designs prior to start of concrete production.
- H. Design mixes to provide normal weight concrete.
- I. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Engineer.
- J. All mix design information and data shall not be older than 18 months from the date of the submittal.

2.7 ADMIXTURES

- A. Use water reducing admixture or high range water reducing admixture (superplasticizer) in concrete as required for placement and workability.
- B. Use high range water reducing admixture in pumped concrete, concrete required to be watertight, and concrete with water/cement ratio below 0.50.
- C. Use nonchloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 degrees F.
- D. Use air-entraining admixture in concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete having an air content of 4% to 6% at the point of placement.
- E. Use admixtures for water reduction and set control in strict compliance with

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

manufacturer's directions.

- F. Temperature Limit: Do not place concrete if the concrete temperature exceeds 90°F or the ambient temperature is 40°F or less and falling.
- G. Slump Limit: Proportion and design mixes to result in concrete slump of 3 to 5 inches at point of placement.

2.8 CONCRETE MIXING

- A. Provide batch ticket for each batch used on the project. Batch ticket must indicate project name, contractor's name, date, mix type, mix time, batch time, quantity, and amount of water introduced.
- B. Ready-Mix Concrete: Comply with requirements of ASTM C94, and as specified.
 - 1. Addition of water to batch for material with insufficient slump will be permitted in accordance with ACI 301.
 - 2. When air temperature is between 85 degrees F. and 90 degrees F., reduce mixing and delivery time from 1-1/2 hours to 75 minutes. When air temperature exceeds 90 degrees F. reduce mixing and delivery time to 60 minutes.
 - 3. Concrete shall only be placed when the air temperature is above 40 degrees F. and rising.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements.
- B. Verify requirements for concrete cover over reinforcement.
- C. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.2 FORMS

- A. General: Design, erect, support, brace, and maintain formwork to support vertical and lateral, static and dynamic loads that might be applied until concrete structure can support such loads.
- B. Maintain formwork construction tolerances complying with ACI 301 Table 4.3.1.
- C. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, chamfers, blocking, bulkheads, anchorages, and other features required in work.
- D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces.
- E. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- F. Chamfer exposed edges and corners as indicated using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- G. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items.
- H. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed.

3.3 VAPOR BARRIER

- A. General: Following leveling and tamping of granular base for slabs-on-grade, place vapor barrier sheeting with longest dimension parallel with direction of pour.
- B. Lap joints 6 inches and seal vapor barrier joints with manufacturer's recommended mastic and pressure-sensitive tape.
- C. After placement of vapor barrier, cover with sand cushion and compact to depth as shown on Drawings.

3.4 PLACING REINFORCEMENT

- A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as herein specified.
 - 1. Avoiding cutting or puncturing vapor retarder during reinforcement placement and concreting operations.
- B. Clean reinforcement of loose rust and mill scale, earth ice, and other materials that reduce or destroy bond with concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
- D. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 JOINTS

- A. Construction Joints: Locate and install construction joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure.
- B. Provide keyways at least 1-1/2 inches deep in construction joints in walls, slabs, beams and between walls and footings.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as otherwise indicated.
- D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- E. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Field-fabricate joints in waterstops in accordance with manufacturer's printed instructions.
- F. Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs-on-ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.
- G. Contraction (Control) Joints in Slabs-On-Grade: Construct contraction joints in slabs-on-ground to form panels of patterns as shown. Use saw cuts 1/8 inch wide by 1/4 slab depth or approved inserts, unless otherwise indicated. Make saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregates.
 - 1. With prior approval from Engineer contraction joints may be formed by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.
 - 2. Refer to drawings for scoring pattern as shown. If joint pattern not shown, provide joints not exceeding 15 feet in either direction and located to conform to bay spacing wherever possible.

3.6 PREPARATION OF FORM SURFACES

- A. Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.
- B. Coat contact surfaces of forms with an approved, noresidual, low-VOC, form-coating compound before reinforcement is placed. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.
- C. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.7 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in.
- B. General: Comply with ACI 304, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete."
- C. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete to avoid segregation at its final location.
- D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

- E. Consolidate full depth of placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.
- F. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
- G. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
 - 1. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or derbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations
 - 3. Maintain reinforcing in proper position during concrete placement.
- H. Cold-Weather Placing: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When placing concrete in cold weather, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
 - 2. Concrete shall only be placed when the air temperature is above 40 degrees F. and rising.
 - 3. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 4. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
- I. Hot-Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI305 and as herein specified.
 - 1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F (32 deg C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.
 - 2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
 - 3. Fog spray forms, reinforcing steel, and subgrade just before concrete is placed.
 - 4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, when acceptable to Engineer.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Rough Form Finish: For formed concrete surfaces not exposed to view in the finish work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.
- B. Smooth Form Finish: For formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or other similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.
- C. Smooth Rubbed Finish: Provide smooth rubbed finish to scheduled concrete surfaced, which have received smooth form finish treatment, not later than one day after form removal.
 - 1. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.
- D. Grout-Cleaned Finish: Provide grout-cleaned finish to scheduled concrete surfaces that have received smooth form finish treatment.
 - 1. Combine one part Portland cement to 1-1/2 parts fine sand by volume, and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water to consistency of thick paint. Blend standard Portland cement and white Portland cement, amount determined by trial patches, so that final color of dry grout will match adjacent surfaces.
 - 2. Thoroughly wet concrete surfaces, apply grout to coat surfaces, and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.
- E. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.
- F. Unless otherwise noted on the Drawings, all exposed surfaces shall receive a smooth rubbed finish.

3.9 SLAB FINISHES

- A. After placing slabs, plane surface to tolerances for floor flatness (Ff) of 15 and floor levelness (Fl) of 13. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushed, brooms, or rakes, as required.
- B. Float Finish: Apply float finish to slab surfaces to receive trowel finish and other finishes as hereinafter specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo; and as otherwise indicated.
 - 1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

driven floats or by hand floating if area is small or inaccessibly to power units. Check and level surface plane to tolerances of Ff 18-FI 15. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

- C. Trowel Finish: Apply trowel finish to slab surfaces to be exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system.
 - 1. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of Ff 20-FI 17. Grind smooth surface defects that would telegraph through applied floor covering system.
- D. Nonslip Broom Finish: Apply nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.
- E. Nonslip Aggregate Finish: Apply nonslip aggregate finish to concrete stair treads, platforms, ramps, sloped walks, and elsewhere as indicated.
- F. After completion of float finishing and before starting trowel finish, uniformly spread 25 lbs. of dampened nonslip aggregate per 100 sq. ft. of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as herein specified.
- G. After curing, lightly work surface with a steel wire brush, or an abrasive stone, and water to expose nonslip aggregate.

3.10 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply in accordance with manufacturer's instructions after screeding and bull floating, but before power floating and troweling.
- B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting; keep continuously moist for not less than 7 days.
- C. Curing Methods: Perform curing of concrete by curing and sealing compound, moist curing, by moisture-retaining cover curing, and by combinations thereof, as herein specified.
- D. Provide moisture curing by following methods.
 - 1. Keep concrete surface continuously wet by covering with water.
 - 2. Use continuous water-fog spray.
 - 3. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4-inch lap over adjacent absorptive

covers.

3.11 REMOVAL OF FORMS

- A. General: Formwork not supporting weight of concrete, such as sides of beams, walls columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.
- B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed until approved by the structural engineer.
- C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

3.12 CONCRETE SURFACE REPAIRS

- A. General: No surface shall be patched or repaired until the Engineer had reviewed the defective condition and approved the Contractor's submitted repair and/or patching materials and procedures.
- B. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Engineer.
 - 1. Cut out honeycomb, rock pockets, and voids over 1/4 inch in any dimension, and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. Place patching mortar before bonding compound has dried.
 - 2. For exposed-to-view surfaces, blend white portland cement and standard portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
- C. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Engineer. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry-pack mortar, or precast cement cone plugs secured in place with bonding agent.
 - 1. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.
- D. Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having required slope.
 - 1. Repair finished unformed surfaces that contain defects that affect durability of concrete. Surface defects, as such, include crazing and cracks in excess of 0.01 in wide or that penetrate to reinforcement or completely through nonreinforced

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- sections regardless of width, spalling, popouts, honeycomb, rock pockets, and other objectionable conditions.
2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
 3. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with patching compound. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Engineer.
 4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, when acceptable to Engineer by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
- E. Repair isolated random cracks and single holes not over 1 inch in diameter by dry-pack method when acceptable to Engineer. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.
- F. Perform structural repairs with prior approval of Structural Engineer for method and procedure, using specified epoxy adhesive and mortar.
- G. Repair methods not specified above may be used, subject to acceptance of Engineer.

3.13 FIELD QUALITY ASSURANCE, CONTROL AND TESTING DURING CONSTRUCTION

- A. General: The Owner will employ CDG Engineers and Associates to perform the required quality assurance testing during construction. The Contractor will notify the Engineer at least 24 hours prior to requiring tests. The Contractor is responsible to provide equipment to allow sampling and testing of the concrete at the point of placement.
- B. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94. Perform the following tests.
1. Slump: ASTM C 143; one test at point of placement for each set of compression test specimens; additional tests when concrete properties appear to have changed.
 2. Air Content: ASTM C 173 (volumetric method for lightweight or normal weight concrete) or ASTM C 231 (pressure method for normal weight concrete); one test at point of placement for each set of compression test specimens; additional tests when concrete properties appear to have changed.
 3. Concrete Temperature: ASTM C 1064; test hourly when air temperature is 40°F and below or 80°F and above, and each time a set of compression test specimens is made.
 4. Compression Test Specimen: ASTM C 31; one set of 4 cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cure test specimens are required.
 5. Compressive Strength Tests: ASTM C 39; one set for each 50 cubic yards or fraction thereof for each concrete class placed in any one day. One specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing, if required.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

6. When frequency of testing will provide fewer than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
- C. Test results will be reported in writing to Engineer, Ready-Mix Producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete supplier and testing agency, concrete type and class, location of concrete placed in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.
- D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but **shall not** be used as the sole basis for acceptance or rejection.
- E. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Engineer. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.
- F. Quality Assurance consisting of testing and observation of a limited sampling of construction materials will be provided by the Owner for acceptance purposes. Passing test results are not a warranty, guarantee, or certification by the testing agency, Engineer, or Owner that all work was performed in conformance with the plans and specifications. Therefore, the Contractor should not rely solely on test results generated by the quality assurance process as an indication of the suitability of the construction.
- G. It is entirely the Contractor's responsibility to perform quality control as necessary to construct the project in conformance with the plans and specifications. Deviations from the plans and specifications, whether identified during construction or following the completion of construction, must be corrected by the Contractor at no cost to the Owner.

3.14 DEFECTIVE CONCRETE

- A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- B. Repair or replacement of defective concrete will be determined by Engineer.
- C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

END OF SECTION
03 30 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

SECTION 03 35 43.16
POLISHED CONCRETE FLOOR FINISHING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Concrete polishing including the following:
 - 1. Grinding and honing concrete surface to receive pure reactive colloidal silica concrete densifier.
 - 2. Application of pure reactive colloidal silica concrete densifier.
 - 3. Progressively refining, polishing of the densified concrete surface.
 - 4. Application of polished concrete protective treatment.

1.2 RELATED SECTIONS

- A. Contract Modification Procedures.
- B. Contractor Quality Control.
- C. Section 01 60 00 - Product Requirements.
- D. Section 03 30 00 - Cast-in-Place Concrete.

1.3 REFERENCES

- A. American Society of Concrete Contractors (ASCC) Subgroup - Concrete Polishing Council (CPC) Polished Concrete Definition: D 100.1.
- B. American National Standard Institute National Floor Safety Institute (ANSI/NSF):
 - 1. ANSI/NSFI B101.1 - Test Method for Measuring Wet SCOF of Common Hard-Surface Floor Materials.
- C. ASTM International (ASTM):
 - 1. ASTM C1028 - Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
 - 2. ASTM C1353 - Standard Test Method for Abrasion Resistance of Dimension Stone Subjected to Foot Traffic Using a Rotary Platform, Double-Head Abraser.
 - 3. ASTM D523 - Standard Test Method for Specular Gloss.
 - 4. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
 - 5. ASTM E96/96M Method B (Water Method) - Standard Test Methods for Water Vapor Transmission of Materials.
 - 6. ASTM G154 - Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Installation Meeting: Convene before the start of work on new concrete slabs, patching of existing concrete slabs, and start of application of concrete finish system.
 - 1. Require attendance of parties directly affecting work of this section, including the Owner's Representative, Contractor, Architect, concrete installer, and surface treatment/polishing contractor. Meeting should only convene when required parties

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- are present.
2. Review the Following:
 - a. Physical requirements of completed concrete slab and slab finish.
 - b. Locations and time of test areas.
 - c. Protection of surfaces not scheduled for finish application.
 - d. Surface preparation.
 - e. Application procedure.
 - f. Quality control.
 - g. Cleaning.
 - h. Protection of finish system.
 - i. Coordination with other ongoing work.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 33 00 - Submittals.
- B. Shop Drawings: Indicate information on shop drawings as follows:
 1. Layout including dimensions and floor grinding schedule.
 2. Plan view of floor and joint pattern layout.
 3. Areas to receive colored surface treatment.
 4. Hardener, sealer, densifier identified in notes.
- C. Product Data: Submit product data, including manufacturer's product data sheets, for specified products.
 1. Safety Data Sheets (SDS).
 2. Preparation and concrete grinding procedures.
 3. Colored Concrete Surface, Dye Selection Guides.
- D. VOC Certification: Submit certification that products furnished comply with regulations controlling use of volatile organic compounds (VOC).
- E. Certificates:
 1. Letter by manufacturer stating that installer is listed applicator of specified products, and has completed the necessary training programs.
- F. Floor protection plan.
- G. Warranty: Submit warranty documents specified.
- H. Operation and Maintenance Data: Submit operation and maintenance data for installed products.
 1. Manufacturer's instructions on maintenance renewal of applied treatments.
 2. Protocols and product specifications for joint filing, crack repair and/or surface repair.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
 1. Applicator to be familiar with specified requirements and methods needed for proper performance of work of this section. Must have available proper equipment to perform work within scope of this project on a timely basis. Applicator should have successfully performed a minimum of 4 projects of similar scope and complexity.
- B. Concrete finishing components and materials shall be from single manufacturer.
- C. Manufacturer Qualifications:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Manufacturer capable of providing field service representation during construction and approving application method.
 2. Manufacturer shall have a minimum 5 years of experience in manufacturing components similar to or exceeding requirements of project.
- D. Mock-Ups: On site, prior to the start of the polished concrete finishing process.
1. Require attendance of parties directly affecting work of this Section, including the Contractor, Architect, applicator, and Owner's Representative.
 2. Notify the above parties one week in advance of date and time when mock-up will be completed.
 3. Demonstrate the materials, equipment and application methods to be used for work specified herein in pre-approved location approximately 50 sq ft (4.645 sq m) in area or as directed by Architect.
 4. Retain approved mock-up during construction as a standard for judging the completed work. Areas may remain as part of the completed work.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in original containers, with seals unbroken, bearing manufacturer labels indicating brand name and directions for storage.
- B. Store concrete hardener/densifier and surface protectant treatment in environment recommended on published manufacturer's product data sheets.
1. Store containers upright in a cool, dry, well-ventilated place, out of the sun with temperature between 40 and 100 degrees F (4 and 38 degrees C).
 2. Protect from freezing.
 3. Store away from other chemicals and potential sources of contamination.
 4. Keep lights, fire, sparks and heat away from containers.
 5. Do not drop containers or slide across sharp objects.
 6. Do not stack pallets more than three high.
 7. Keep containers tightly closed when not in use.

1.8 PROJECT CONDITIONS

- A. Environmental limitations:
1. Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting performance and finishing requirements.
- B. Close areas to traffic during floor application and after application for time period recommended in writing by manufacturer.
- C. Protect the completed slab to prevent damage by the other trades during floor completion.
- D. Temperature Limitations:
1. Apply when surface and air temperature are between 40 degrees F (4 degrees C) and 95 degrees F (35 degrees C) unless otherwise indicated by manufacturer's written instructions.
 2. Apply when surface and air temperatures are expected to remain above 40 degrees F (4 degrees C) for a minimum of 8 hours after application, unless otherwise indicated by manufacturer's written instructions.
- E. Apply when air conditions are calm to minimize surface treatment contacting surface not intended to be finished.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- F. Do not apply to frozen substrate. Allow adequate time for substrate to thaw if freezing conditions exist before application.
- G. Apply a minimum of 24 hours after rain event. Suspend application when rain is anticipated for a period of 8 hours after application, unless otherwise indicated by manufacturer's written instructions.
- H. Temporary Heat: Ambient temperature of 50 degrees F (10 degrees C) minimum.
- I. Ventilation: Provide adequate ventilation in confined or enclosed areas in accordance with manufacturer's instructions.

1.9 SEQUENCING

- A. Sequence with Other Work: Comply with manufacturer's written recommendations for sequencing construction operations.

1.10 WARRANTY

- A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and does not limit, other rights Owner may have under Contract Documents.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Solomon, Scofield, Ashford, Epmar, Laticrete or prior approved equivalent.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 MATERIALS

- A. Water-based, Colloidal silica blended surfactant used for cutting aid: Product used to extend the life of diamond tooling and minimize concrete surface scratches during the wet-grinding process if requires to cut the concrete cap.
 - 1. Basis of Design: Lythic Cleaner manufactured by Solomon Colors, Incorporated.
 - 2. Subject to compliance with the following requirements:
 - a. Comply with national, state and district AIM VOC regulations and contains 0.067 oz per gal (0.5 g per L) or less.
 - b. Formulated with colloidal silica and cleaning surfactants
- B. Penetrating Concrete Densifier: Colloidal silica concrete densifier.
 - 1. Basis of Design: Lythic Densifier or Lythic Densifier XL manufactured by Solomon Colors, Incorporated.
 - 2. Subject to compliance with the following requirements:
 - a. Abrasion Resistance: Greater than 60 percent improvement over untreated samples when tested in accordance with ASTM C1353 or ASTM C779
 - b. Coefficient of Friction: Greater than 0.60 dry, Greater than 0.60 wet when tested in accordance with ASTM C1028.
 - c. Adhesion: Greater than 10 percent increase in pull-off strength when compared to an untreated sample when tested in accordance with ASTM D4541.
 - d. UV Stability: No degradation or yellowing of material when tested in accordance

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- e. Colloidal silica particles size ranging from 3 to 60 nanometers
 - f. Chemical pH no greater than pH10
- C. Polished Concrete Protective Treatments:
- 1. Polished concrete film forming concrete protector, colloidal silica sealer.
 - a. Basis of Design: Lythic Protector manufactured by Solomon Colors, Incorporated.
 - b. Subject to compliance with the following requirements:
 - 1) Contain reactive colloidal silica
 - 2) Comply with national, state and district AIM VOC regulations.
 - 3) Achieve ' High Traction Range' readings when tested in accordance with ANSI B101.1.
 - 4) Coefficient of Friction: Greater than 0.60 dry, greater than 0.60 wet when tested in accordance with ASTM C1028.
 - 5) Adhesion: : Greater than 10 percent increase in pull-off strength when compared to an untreated sample when tested in accordance with ASTM D4541.
 - 6) UV Stability: No degradation or yellowing of material when tested in accordance with ASTM G154.
- D. Polished Concrete After Treatments:
- 1. Polished concrete film forming concrete protector, colloidal silica sealer.
 - a. Basis of Design: Lythic Cleaner manufactured by Solomon Colors, Incorporated.
 - b. Subject to compliance with the following requirements:
 - c. Comply with national, state and district AIM VOC regulations and contains 0.067 oz per gal (0.5 g per L) or less.

2.3 EQUIPMENT

- A. Auto Scrubber Machine: For cleaning operations.
- B. Hand Grinder or stand-up edger for edge grinding/polishing.
- C. Grinding/Polishing Equipment:
 - 1. Dry grinding/polishing machines shall include a dust extraction system, including HEPA filtration vacuum.
- D. Diamond Segments:
 - 1. Use heads from the same manufacturers throughout the entirety of the project.
- E. Diamond Heads Types:
 - 1. Metal Diamonds: 16 or 200.
 - 2. Hybrid Style Diamonds: 30 or 100.
 - 3. Resin, Phenolic or Ceramic Bonded Diamonds: 100, 200, 400, 800, 1500, and 3000 (Grit range will depend on individual tooling manufacturers system).
- F. Burnishing Machine and Burnishing Pads to produce specified results.
 - 1. Burnishing Machine: High-speed burnisher, generating pad speeds of 1,500 RPM or higher, as recommended by protective treatment manufacturer. Dust skirt must be installed at time of work.
 - 2. Burnishing Pads: as recommended by protective treatment manufacturer.
 - a. White Burnishing Pad, non-abrasive.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- b. Abrasive diamond burnishing pads selective grades 200, 400, 600, 800, 1000, 1500, 3000

PART 3 EXECUTION

3.1 EXAMINATION

- A. Site Verification of Conditions:
 - 1. Verify that concrete substrate conditions, which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer's instructions prior to installation of concrete finishing materials.
- B. Ensure surfaces are clean and free of dirt and other foreign matter harmful to performance of concrete finishing materials.
- C. Examine surface to determine soundness of concrete for polishing.
- D. Do not begin installation until substrates have been properly prepared. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.
- E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Repair, patch and fill cracks, voids, defects and damaged areas in surface as approved by the Architect. Allow repair materials to cure completely before carrying out additional work, grinding or product application.
- B. Variations in substrate texture and color will affect final appearance, should be corrected prior to application of colloidal silica concrete densifier, refined polishing stages and protective treatments.
- C. Protect surrounding areas prior to application. If product is accidentally sprayed or spilled to adjacent surfaces, flush with water immediately before material dries.
- D. Seal open joints in accordance with Section 07 90 00.
- E. Apply specified sealants and caulking and allow complete curing before application of penetrating colloidal silica concrete densifier.

3.3 CONCRETE GRINDING, HONING, AND POLISHING

- A. Adhere to industry standard grinding, honing, and polishing procedures for dry and wet grinding and honing. (Reference ASCC - Concrete Polishing Council CPC Polished Concrete Definition: D 100.1)
- B. Scrub and rinse slab surface with clean water and vacuum with auto-scrubber between and after final passes.
- C. Sequential progression of diamond tooling steps shall be required and limited to no more than double the grit value of the previous diamonds used.
- D. Overlap adjacent passes by 25 percent.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- E. Perform each pass perpendicular to the other pass north/south then east/west; multiple passes may be needed.
- F. Progressively grind, hone and polish the slab surface utilizing approved diamond segments as necessary to produce finishing requirements.
 - 1. Grout Coat material to fill gaps, voids and pop-outs during grinding operation per manufacturer's published recommendations.
 - 2. Apply water-based, Colloidal Silica blended surfactant cutting aid during the initial wet grinding process per manufacturer's published recommendations. (Typically during any metal diamond tooling stages and only if wet grinding is required).

3.4 APPLICATION OF COLLOIDAL SILICA CONCRETE DENSIFIER

- A. Apply Colloidal Silica concrete densifier at the rate of 350 to 650 square feet per gallon with a low-pressure sprayer. (Application stage can range from 100-grit metal tooling to 400-grit resin tools depending on the concrete condition).
- B. Apply sufficient material to the point of saturation keeping concrete surface wet for 5 to 15 minute period, without producing puddles.
- C. Allow treated surface to gel and dry. (Do not remove gel during reaction, it will not leave a residue and will not crystalize on the surface)
- D. Continue progressively polishing floor with required resin diamonds as necessary to produce desired final finish.
- E. Repeat step (A) Applying Colloidal Silica concrete densifier as needed to harden excessively soft concrete surfaces.

3.5 APPLICATION OF POLISHED CONCRETE PROTECTIVE TREATMENTS:

- A. Application Polished concrete gloss film forming concrete protector, colloidal silica sealer:
 - 1. Apply per manufacturer's published recommendations to clean, dry slab at the completion of mechanically polishing the slab surface.
 - 2. Lightly wet a clean microfiber mop or cotton pad with protective treatment and wring out excess, leaving the pad damp.
 - 3. Working from one control joint to another, apply a light, fine spray of protective treatment to a small section of the floor using a clean, pump-up sprayer fitted with a 0.5 gpm spray tip or fog sprayer, at an estimated coverage rate of 1200 to 1800 square feet per gallon.
 - 4. Using the damp microfiber mop or cotton pad with firm downward pressure, immediately spread the protective treatment to produce an even thin coating. Spread the product as far as possible while maintaining a wet edge. Properly applied, protective treatment dries quickly. Stop spreading once drying begins. Avoid overlapping.
 - 5. Allow to dry tack free, typically 20 to 60 minutes.
 - 6. Once dry, high- speed burnish slab surface fitted with manufacturer recommended burnishing pad to increase gloss and to help the treatment fuse and bond with the concrete for increased durability and longevity. (Burnish between coats if multiple applications are required.)
 - 7. Repeat above steps 1 through 6, as necessary for additional applications of protective treatment, to achieve desired final finish (Not exceeding 4 coats).
- B. Application of interior high performance sealer high gloss, film forming sealer:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Mix interior high performance sealer per manufacturer's instructions.
2. Apply to clean, dry slab at the completion of mechanically polishing no higher than 800-grit. (200-grit to 800-grit produces optimum surface preparation for chemical bond. Ensure scratch pattern is not visible before application)
3. Lightly wet a lint free short nap paint roller with interior high performance sealer and remove excess, leaving primed paint roller.
4. Roll out interior high performance sealer using minimal downward force. Evenly roll the interior high performance sealer without leaving overlap lines at an estimated coverage rate of 1000 to 1500 square feet per gallon. Working from one control joint to another.
5. Maintain a thin, even coating and wet edge. Do not over apply.
6. Allow 4-6 hours before of dry time before a second application is applied (Only re-coat if needed) Repeat steps 1 through 4 for re-coat application.
7. To increase gloss, wait at least 12 to 24 hours after the final coat is applied, then use a high- speed burnisher fitted with a burnishing pad. Burnish at a slow walking pace.

3.6 SLAB PROTECTION

- A. COMPLETELY Protect finished floors to prevent damage including staining, gouges and scratching by construction traffic and activities until possession.
- B. Do not drag or drop equipment or material across the slab which will scratch or chip it.
- C. Inspect tires for debris prior to use on slab. Remove embedded items which may cause damage to floor slab.
- D. Clean up spills on slab immediately. Provide cleaning chemicals and absorptive materials.
- E. Develop a concrete protection procedure which addresses the following procedures:
 1. Communication of protection plan to subcontractors and vendors.
 2. Procedures for cleaning up slab spills, including use of and availability of cleaning chemicals and absorptive materials at Site.
- F. Provide a clean slab surface using concrete maintenance cleaner within an auto scrubber, equipped with soft nylon brushes, in accordance with manufacturer's published recommendations.

3.7 FINISHING REQUIREMENTS

- A. Appearance:
 1. Interior exposed finished slab areas must consist of the following:
 - a. Slab surface must meet the desired sheen, as discussed in Pre-Installation meeting and be consistent with approved Mock-up.
 - b. Slab surface must have a consistent look and exhibit a finish that has no evidence of streaking or burnish marks.
 - c. White residue or hazy appearance is not acceptable.
 - d. Exposure of aggregate beyond Concrete Polishing Council Class is not acceptable.
 - 1) Aggregate Exposure Class: B-Fine Aggregate.
 2. Interior exposed finished slab areas must consist of the following Concrete Polishing Council Gloss Level:
 - a. Finished Gloss Level 2: Satin Gloss Appearance.
- B. Re-finish those areas not meeting specified gloss levels per mock-up.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3.8 FINAL CLEANING

- A. Upon completion, remove surplus and excess materials, rubbish, tools and equipment.

3.9 PROTECTION

- A. Protect installed product from damage during construction in accordance with manufacturer's recommendations.

END OF SECTION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 3: CONCRETE
Section 03 39 05: Sealer-Hardener for Concrete Floors

PART 1 GENERAL

Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section.

1.1 SECTION INCLUDES

- A. Single application sealer-hardener for concrete floors.
- B. Precautions for avoiding staining concrete before and after application.

1.2 RELATED SECTIONS

- A. Section 03300 - Cast-In-Place Concrete.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data: Manufacturer's data sheets, including product specifications, test data, preparation instructions and recommendations, storage and handling requirements and recommendations, and installation methods.
- C. Maintenance instructions, including precautions for avoiding staining after application.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Applicator experienced with installation of product and certified by manufacturer, or applicator experienced with similar products and providing manufacturer's field technician on site to advise on application procedures; and providing adequate number of skilled workers trained and familiar with application requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver product in factory numbered and sealed drums, with numbers recorded for Owner's records.
- B. Store products in manufacturer's unopened drums until ready for installation.

1.6 PROJECT CONDITIONS

- A. No satisfactory procedures are available to remove petroleum or rust stains from concrete. Prevention is therefore essential. Take precautions to prevent staining of concrete prior to application of sealer-hardener and for minimum of three months after application:
 - 1. Prohibit parking of vehicles on concrete slab.
 - 2. If vehicles must be temporarily parked on slab, place drop cloths under vehicles during entire time parked.
 - 3. If construction equipment must be used for application, diaper all components that might drip oil, hydraulic fluid, or other liquids.
 - 4. Prohibit pipe cutting using pipe cutting machinery on concrete slab.
 - 5. Prohibit temporary placement and storage of steel members on concrete slab.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. Do not install products under environmental conditions outside manufacturer's absolute limits.
- C. Do not use frozen material; thaw and agitate prior to use.

1.7 WARRANTY

- A. Provide manufacturer's warranty that a structurally sound concrete surface prepared and treated according to the manufacturer's directions will remain permanently dustproof, hardened and water repellent. If after the specified sealing period the treated surface does not remain dustproof, hardened and water repellent, provide, at manufacturer's expense, sufficient material to reseal defective areas.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Ashford Formula, by Curecrete (800-998-5664) – basis of design or approved equal.
- B. Requests for substitutions will be considered in accordance with provisions of the General Conditions.

2.2 MATERIALS

- A. Sealer-Hardener: Ashford Formula (basis of design); water-based chemically reactive penetrating sealer and hardener, that seals by densifying concrete so that water molecules cannot pass through, but air and water vapor can, while allowing concrete to achieve full compressive strength, minimizing surface crazing, and eliminating dusting.
 - 1. Colorless, transparent, odorless, non-toxic, non-flammable.
 - 2. Containing no solvents or volatile organic compounds.
 - 3. USDA approved for food handling facilities.
 - 4. Allowing traffic on floors within 2 to 3 hours, with chemical process complete within 3 months.
 - 5. No change to surface appearance except a sheen developed due to traffic and cleaning.
- B. Water: Clean, potable.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly cured, prepared and are suitable for application of product.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Install in accordance with manufacturer's instructions.
- B. If this is the applicator's first project using this product, provide the manufacturer's technical representative on-site to familiarize installers with proper procedures.
- C. Prevent damage to and soiling of adjacent work.
- D. Concrete: Apply sealer-hardener only to clean bare concrete.
 - 1. Ensure concrete is properly cured prior to application, follow manufacturer's recommendations.
 - 2. Saturate surface with sealer-hardener; respray or broom excess onto dry spots.
 - 3. Keep surface wet with sealer-hardener for minimum soak-in period of 30 to 40 minutes.
 - 4. If, after the 30-minute soak-in period, most of the material has been absorbed, remove all excess material using broom or squeegee, especially from low spots.
 - 5. If, after the 30-minute soak-in period, most of the material remains on the surface, wait until it becomes slippery and then flush entire surface with water removing all residue of sealer-hardener and squeegee completely dry, flushing any remaining slippery areas until no residue remains.
 - 6. If water is not available, remove residue using squeegee.

3.4 PROTECTION

- A. Protect installed floors until chemical reaction process is complete.
 - 1. Comply with precautions listed under PROJECT CONDITIONS.
 - 2. Clean floor regularly in accordance with manufacturer's recommendations because water will accelerate the sealing and scrubbing will impart a shine.
 - 3. Clean up spills immediately and spot-treat stains with good degreaser or oil emulsifier.
- B. Precautions and cleaning are the responsibility of the General Contractor until Final Acceptance by the Owner.

END OF SECTION 03 39 05

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 3 CONCRETE
Section 03 41 00 Cast Site Concrete

GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete sidewalks.
 - 2. Concrete stair steps.
 - 3. Concrete integral curbs gutters.
 - 4. Concrete parking areas and roads.

- B. Related Sections:
 - 1. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section.

1.2 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 301 - Specifications for Structural Concrete.
 - 2. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.

- B. ASTM International:
 - 1. ASTM A185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
 - 2. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
 - 3. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - 4. ASTM C33 - Standard Specification for Concrete Aggregates.
 - 5. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
 - 6. ASTM C150 - Standard Specification for Portland Cement.
 - 7. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
 - 8. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - 9. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
 - 10. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
 - 11. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - 12. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

1.3 UNIT PRICE – N/A

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

- B. Product Data: Submit data on joint filler, admixtures, and curing compounds.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301; requirements of Sections 03 20 00 and 03 30 00.
- B. Maintain one copy of each document on site.
- C. Obtain cementitious materials from same source throughout.
- D. Sealants whose shelf life has expired shall be removed from the site.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum three years' experience.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.
- B. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 PRODUCTS

2.1 FORM MATERIALS

- A. Joint Filler: ASTM D1751, 1/2-inch thick, non-extruding, asphalt impregnated fiberboard
- B. Joint Sealant: ASTM C920, Type S, Grade NS, Class 25.

2.2 REINFORCEMENT

- A. Refer to Section 03 30 00 – Cast-In-Place Concrete.

2.3 SOURCE QUALITY CONTROL AND TESTS

- A. Section 01 40 00 - Quality Requirements: Testing and Inspection Services
- B. Submit proposed mix design to Engineer for review prior to commencement of Work.
- C. Tests on cement, aggregates, and mixes will be performed to ensure conformance with specified requirements.
- D. Test samples in accordance with ACI 301.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2.4 JOINT DEVICES AND FILLER MATERIALS

- A. Joint Filler Type A: ASTM D994; Asphalt impregnated fiberboard or felt, thickness as indicated on the drawings; tongue and groove profile.
- B. Joint Filler Type B: ASTM D1751; cellular bonded fiber material, non-extruding, resiliency recovery of 70 percent if not compressed more than 50 percent of original thickness.
- C. Construction Joint Devices: Integral galvanized steel, formed to tongue and groove profile, with removable top strip exposing sealant trough, knockout holes spaced at 6 inches, ribbed steel spikes with tongue to fit top screed edge.
- D. Expansion and Contraction Joint Devices: ASTM B221 alloy, extruded aluminum; resilient neoprene filler strip with Shore A hardness of 35 to permit plus or minus 25 percent joint movement with full recovery; extruded aluminum of longest manufactured length at each location, flush mounted.
- E. Joint Sealant: ASTM C920, Type S; single component, self-leveling, premium grade polyurethane sealant, equal to Sikaflex-1C SL.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify compacted subgrade or base is acceptable and ready to support paving and imposed loads.
- C. Verify gradients and elevations of base are correct.

3.2 PREPARATION

- A. Moisten base to minimize absorption of water from fresh concrete.
- B. Coat surfaces of manhole and catch basin frames with oil to prevent bond with concrete pavement.
- C. Notify Engineer minimum 24 hours prior to commencement of concreting operations.

3.3 FORMING

- A. Place and secure forms to correct location, dimension, profile, and gradient.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.4 REINFORCEMENT

- A. Place reinforcement as indicated.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. Interrupt reinforcement at expansion joints.
- C. Place dowels to achieve pavement and curb alignment as detailed.

3.5 PLACING CONCRETE

- A. Place concrete in accordance with ACI 301 and as specified in Section 03 30 00.
- B. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.
- C. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

3.6 JOINTS

- A. Place expansion joints at 20-foot intervals. Align curb, gutter, and sidewalk joints.
- B. Place joint filler between paving components and building or other appurtenances. Recess top of filler 1/4 inch for sealant placement.
- C. Provide sawn joints at 4 feet intervals.
- D. Provide keyed joints as indicated.
- E. Saw cut contraction joints 3/16 inch wide at an optimum time after finishing. Cut 1/3 into depth of slab.

3.7 EXPOSED AGGREGATE – Not Used

- A. Apply surface retarder where exposed aggregate finish is required.
- B. Wash exposed aggregate surface with clean water and scrub with stiff bristle brush exposing aggregate.

3.8 FINISHING

- A. Paving: Light broom.
- B. Sidewalk Paving: Light broom, and trowel joint edges.
- C. Curbs and Gutters: Light broom.
- D. Direction of Texturing: Transverse to pavement direction.
- E. Inclined Vehicular Ramps: V-jointed perpendicular to slope.

3.9 JOINT SEALING

- A. Separate pavement from vertical surfaces with 1/4 inch thick joint filler.
- B. Place joint filler in pavement pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- C. Extend joint filler from bottom of pavement to within 1/4 inch of finished surface.

3.10 TOLERANCES

- A. Section 01 40 00 - Quality Requirements: Tolerances.
- B. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.
- C. Maximum Variation from True Position: 1/4 inch.

3.11 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Testing and inspection services.
- B. Three concrete test cylinders will be taken for every 75 or less cu. yds of concrete placed each day.
- C. One additional test cylinder will be taken during cold weather and cured on site under same conditions as concrete it represents.
- D. One slump test will be taken for each set of test cylinders taken.
- E. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.12 PROTECTION

- A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.
- B. Do not permit pedestrian or vehicular traffic over pavement for days minimum after finishing.

END OF SECTION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 3: CONCRETE
Section 03 41 02: Precast Prestressed Hollow Core Slabs

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this Section.

1.2 SUMMARY

- A. This section includes 4'-0" wide only precast prestressed hollow core slabs as indicated on drawings and as specified herein at the Jail Building only. No other panel width will be allowed.
- B. Prestressed structural framing members are specified in other sections of this Division.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract.
- B. Product data and instructions for manufactured materials and products. Include manufacturer's certifications and laboratory test reports as required.
- C. Shop drawings and coordination with Jail project final coordination drawings showing complete information for fabrication and installation of precast concrete units. Indicate member dimensions and cross-section as well as location, size, and type of reinforcement hole locations by others etc., including special reinforcement and lifting devices necessary for handling and erection.
 - 1. This contractor shall participate in the project final coordination drawings required of The General Contractor and all trades as specified herein! This coordination will include hole layout in hollow core and all coordination with fire protection, plumbing, mechanical, electrical, and electronica security elements.
- D. Provide layout, dimensions, and identification of each precast unit corresponding to sequence and procedure of installation. Indicate welded connections by AWS standard symbols. Detail inserts, connections, and joints, including accessories and construction at openings in precast units.
- E. Indicate location and details of anchorage devices that are to be embedded in other construction. Furnish templates if required for accurate placement.
- F. Provide complete design calculations and any design deviation (to include thickness) prepared by a registered engineer licensed in state where project is erected.

1.4 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of following codes, specifications, and standards, except as otherwise indicated:
 - 1. ACI 301 "Specifications for Structural Concrete for Buildings."
 - 2. ACI 318 "Building Code Requirements for Reinforced Concrete."

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Prestressed Concrete Institute MNL 116, "Manual for Quality Control for Plants and Production of Precast Concrete Products."
- B. Fabricator Qualifications: Firms with at least two years successful experience in fabrication of precast concrete units similar to units required for this project will be acceptable.
 1. Fabricator must be producer member of the Prestressed Concrete Institute (PCI) and/or participate in its Plant Certification Program.
 - C. Fabrication Qualifications: Produce precast concrete units at fabricating plant engaged primarily in manufacturing of similar units unless plant fabrication or delivery to project site is impractical.
 - D. If units are not produced at precast concrete fabricating plant, maintain procedures and conditions for quality control that are equivalent to plant production.
 1. Comply with PCI MNL - 116 for production of precast concrete units.
 - E. Fire-resistance-Rated Precast Units: Where precast concrete units are shown or scheduled as requiring a fire-resistance classification, provide units tested and listed by UL in "Fire Resistance Directory" or with each unit bearing UL label and marking.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver precast concrete units to project site in such quantities and at such times to assure continuity of installation. Store units at project site to prevent cracking, distortion, staining, or other physical damage and so that markings are visible. Lift and support units at designated lift points.

1.6 FIELD CONDITIONS

- A. Design modifications may be made as necessary to meet field conditions, to ensure proper fitting of work, and as acceptable to Architect. Changes to general design concept as shown identified to Architect and must be acceptable to Architect.
- B. Deliver anchorage items that are to be embedded in other construction before start of such work. Provide setting diagrams, templates, and directions as required for installation.

PART 2 - PRODUCTS

2.1 PRESTRESSING TENDONS

- A. Uncoated, 7-wire stress-relieved strand complying with ASTM A 416. Use Grade 250 unless Grade 270 indicated.
- B. Strand similar to above but having size and ultimate strength of wires increased so that ultimate strength of the strand is increased approximately 15 percent, or strand with increased strength but with fewer wires per strand, may be used at manufacturer's option.

2.2 CONCRETE MATERIALS

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Portland Cement: ASTM C 150, Type I or Type III.
 - 1. Use only one brand and type of cement throughout project unless otherwise acceptable to Architect.
- B. Aggregates: ASTM C 33.
 - 1. Local aggregates not complying with ASTM C 33, but that have been shown by special test or actual service to produce concrete of adequate strength and durability, may be used when acceptable to Architect.
- C. Lightweight Aggregate: ASTM C 330.
- D. Water: Drinkable and free from foreign materials in amounts harmful to concrete and embedded steel.
- E. Air-Entraining Admixture: ASTM C 260.
- F. Water-Reducing Admixture: ASTM C 494, Type A.

2.3 CONNECTION MATERIALS

- A. Weld Plates: Structural quality, hot-rolled carbon steel, ASTM A 283, Grade C.
- B. Steel Shapes: ASTM A 36.
- C. Anchor Bolts: ASTM A 307, low-carbon steel bolts, regular hexagon nuts, and carbon steel washers.
- D. Finish of Steel Units: Exposed units galvanized per ASTM A 153; others painted with rust-inhibitive primer.
- E. Accessories: Provide clips, hangers, and other accessories required for installation of project units and for support of subsequent construction of finishes.
- F. Cement Grout: Portland cement, ASTM C 150, Type I, and clean natural sand, ASTM C 404. Mix at ratio of 1.0-part cement to 3.0 parts sand, by volume, with minimum water required for placement and hydration.
- G. Bearing Pads: Tempered hardboard, smooth on both sides, complying with AHA A 135.4.

2.4 PROPORTIONING AND DESIGN OF MIXES

- A. General: Prepare design mixes for each type of concrete required.
- B. Design mixes may be prepared by an independent testing facility or by qualified precast manufacturing plant personnel, at precast manufacturer's option.
 - 1. Produce standard-weight concrete consisting of specified portland cement, aggregates, admixtures, and water to produce the following properties:
 - a. Compressive strength; 5,000 psi minimum at 28 days.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- b. Release strength for prestressed units: 3,500 psi.
 2. Produce lightweight concrete consisting of specified portland cement, aggregates, admixtures, and water to produce the following properties:
 - a. Compressive strength; 5,000 psi minimum at 28 days.
 - b. Air-dry density; not less than 90 nor more than 115 lbs. per cu. ft.
 - c. Release strength for prestressed units: 3,500 psi.
 3. Cure compression test cylinders by the same methods used for precast concrete work.
- C. Admixtures: Use water-reducing admixtures in strict compliance with manufacturer's directions. Admixtures to increase cement dispersion or provide increased workability for low-slump concrete may be used if acceptable to Architect.
- D. Use amounts as recommended by admixture manufacturer for climatic conditions prevailing at time of placing. Adjust quantities of admixtures as required to maintain quality control.

2.5 FABRICATION

- A. General: Fabricate 4'-0" wide (only) precast concrete units complying with manufacturing and testing procedures, quality control recommendations, and dimensional tolerances of PCI MNL-116 and in depths as required by Harlow Core Third Party Structural Engineer.
- B. Accurately construct forms of sufficient strength to withstand pressures due to concrete placing operations, temperature changes, and pretensioning and detensioning operations. Maintain formwork to provide completed precast concrete units of shapes, lines, and dimensions indicated, within specified fabrication tolerances.
- C. Furnish units that are free of voids or honeycomb, with straight true edges and surfaces and free from defect.
- D. Standard Finish: Normal plant run finish produced in forms that impart a smooth finish to concrete. Fillable or repairable small surface holes caused by air bubbles, normal form joint marks, and minor chips and spalls will be tolerated, but major or unsightly imperfections, honeycomb or structural defects will not be permitted. Whether plant included or as a product of inappropriate field cutting and setting techniques. All cutting must be done by appropriate Mechanical sawcutting methods. No demolition of slab edges with hammers or other blunt force techniques is acceptable.
- E. Adequately reinforce slab units to resist transporting and handling stresses.
- F. Include cast-in weld plates where required for anchorage or lateral bracing to structural steel members.
- G. Cooperate completely with other trades for installation of items to be cast- in or cut in hollow slab units. Notify General Contractor of items not received in ample time so as not to delay work.
- H. Provide solid, monolithic precast slab units indicated to be an integral part of hollow slab unit system. Design and fabricate solid units to dimensions and details indicated, as specified for hollow slab units.
- I. Provide headers of cast-in-place concrete or structural steel shapes for openings larger than one slab width in accordance with hollow slab unit manufacturer's recommendations.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- J. Dimensional Tolerances: Fabricate hollow core slab units to comply with PCI MNL 116 fabricated dimensional tolerances. In 4'-0" panel width as shown on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lift, place, and secure hollow slab units in accordance with manufacturer's printed instructions, details on drawings, and final shop and Project Coordination drawings, keeping units tight and perpendicular to bearing supports. Do not install hollow slab units until supporting members are in place and secured.
- B. Follow erection procedures and sequence of erection as recommended by hollow slab unit manufacturer and as acceptable to Architect. All erection will be coordinated with all field trades to prevent damage to other trades work.
- C. Installation Tolerances: Install precast units without exceeding following tolerance limits:
1. Variations from Plumb: 1/4 inch in any 20-foot run or story height; 1/2-inch total in any 40-foot or longer run.
 2. Variations from Level or Elevation: 1/4 inch in any 20-foot run; 1/2 inch in any 40-foot run; total plus or minus 1/2 inch at any location.
 3. Variation from Position in Plan: Plus, or minus 1/2 inch maximum at any location.
 4. Offsets in Alignment of Adjacent Members at Any Joint: 1/16 inch in any 10-foot run, 1/4 inch maximum.
- D. Level slabs accurately or set to uniform slope as indicated.
- E. Set slabs on solid, level bearing, with bearing surface of slab units not less than 2 inches at steel supports and not less than 3 inches at other supports, unless otherwise acceptable to Architect. Leave a minimum of 15/8" between bearing ends at all bearing points to accommodate conduit and small piping.
- F. Align and level by methods, procedures, and equipment as recommended by hollow slab unit manufacturer.
- G. Do not cut holes or install sleeves larger than size permitted by hollow slab unit manufacturer for pipe, conduits, duct, or other penetrations after fabrication. Provide complete coordination in General Contractors coordination drawings.
- H. Do not cut reinforcing or prestressing strands without approval of manufacturer.
- I. Field cut holes as shown on drawings or otherwise for openings that do not disturb prestressing strands in accordance with recommendations of hollow slab unit manufacturer. Coordinate all holes cut by others on General Contractors coordination drawings.
- J. At continuous electrical raceway joints, carefully align cells and tape butt joints in accordance with manufacturer's recommendations and to comply with applicable code requirements. Keep hollow cores free from grout and other foreign materials.
- K. This product is a finished ceiling element and as such this subcontractor will grout joints and repair

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

damaged exposed surfaces, as directed by Architect. Place forms or other acceptable method to retain grout in place until sufficiently hard to support itself. Completely fill void with grout to finish smooth and level with adjacent surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed finished surfaces before it hardens.

3.2 PLANT QUALITY CONTROL EVALUATIONS

- A. The Owner may employ a separate testing laboratory to evaluate precast manufacturer's quality control and testing methods.
- B. The precast manufacturer shall allow Owner's testing facility access to materials storage areas, concrete production equipment, and concrete placement and curing facilities. Cooperate with Owner's testing laboratory and provide samples of materials and concrete mixes as may be requested for additional testing and evaluation.
- C. Dimensional Tolerances: Units having dimensions smaller or greater than required, and outside specified tolerance limits, may be subject to additional testing as herein specified.
- D. Precast units having dimensions other than specified and shown on drawings and greater than required will be rejected if appearance or function of the structure is adversely affected or if larger dimensions interfere with other construction. Repair or remove and replace rejected units as required to meet construction conditions. All units must be 4'-0" nominal widths.
- E. Strength of Units: Strength of precast concrete units will be considered potentially deficient if manufacturing processes fail to comply with requirements that may affect strength of precast units, including the following conditions.
 - 1. Failure to meet compressive strength test requirements.
 - 2. Reinforcement, and pretensioning and detensioning of tendons of prestressed concrete, not conforming to specified fabrication requirements.
 - 3. Concrete curing, and protection of precast units against extremes in temperature, not as specified.
 - 4. Precast units damaged during handling and erection.
- F. Testing Precast Units: Where there is evidence that strength of precast concrete units does not meet specification requirements, the concrete testing service shall take core drilled from hardened concrete for compressive strength determination, complying with ASTM C 42 and as follows:
 - 1. Take at least three representative cores from precast units of suspect strength from locations directed by Architect.
 - 2. Test cores in a saturated-surface-dry condition per ACI 318 if concrete will be wet during use of completed structure.
 - 3. Test cores in an air-dry condition per ACI 318 if concrete will be dry during use of completed structure.
 - 4. Strength of concrete for each series of cores will be considered satisfactory if their average compressive strength is at least 85 percent of 28-day design compressive strength.
 - 5. Test results will be made in writing with copies to Architect, General Contractor, and precast manufacturer. Include in test report the project identification name and number, date, name of precast concrete manufacturer, name of concrete testing service, identification letter, number, and type of member or members represented by core tests, design compression strength, compressive breaking strength and type of break (corrected for length-diameter ratio), direction of applied load to core with respect to horizontal plane of concrete as placed, and moisture condition of core at time of testing.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- G. Patching: Where core test results in satisfactory and precast units are acceptable for use in work, fill core holes solid with patching mortar and finish to match adjacent concrete surfaces.
- H. Defective Work: Precast concrete units that do not conform to specified requirements, including strength, tolerances, and finishes, shall be replaced with precast concrete units that meet requirements of this section. General Contractor shall also be responsible for cost of corrections to other work affected by or resulting from corrections to precast concrete work.

END OF SECTION 03 41 02

CALHOUN COUNTY JAIL
ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
DETENTION MODULE PACKAGE
ANNISTON, ALABAMA

DIVISION 3: CONCRETE
Section 03 41 0 Structural Precast Concrete--Plant Cast

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and any general provisions of the Contract for each Prime Contract, including General and Supplementary Conditions and specific requirements apply to this Section.

1.2 SUMMARY

- A. This Section includes structural precast concrete units, including the following:
 - 1. Structural framing units. NOTE: The General Contractor may exercise the option to use Precast beams in lieu of site cast beams in areas associated with Precast hollow core panels and Precast concrete cell modules. Note coordination must be made with Precast cell module manufacturers for bearing applications.
- B. Related Sections: The following sections contain requirements that relate to this Section.
 - 1. Cast-in-place concrete is specified in Division 3 Section "Cast-In-Place Concrete."
 - 2. Joint sealants and backing are specified in Division 7 Section "Joint Sealants."
 - 3. Applied finishes are specified in Division 9 Sections.

1.3 SUBMITTALS

- A. General: Submit the following according to Conditions of Contract.
- B. Product data and instructions for manufactured materials and products. Include manufacturer's certifications and laboratory test reports as required.
- C. Mix design reports of proposed concrete mix as specified in Part 2 of this Section.
- D. Shop drawings prepared by or under the supervision of a qualified professional engineer, showing complete information for fabrication and installation of precast concrete units. Indicate member dimensions and cross-section; location, size, and type of reinforcement, including special reinforcement; and lifting devices necessary for handling and erection.
 - 1. Indicate layout and dimensions, and identify each precast unit corresponding to sequence and procedure of installation. Indicate welded connections by AWS standard symbols. Detail inserts, connections, and joints, including accessories and construction at openings in precast units.
 - 2. Provide location and details of anchorage devices that are to be embedded in other construction. Furnish templates, if required, for accurate placement.
- E. Samples of bearing pads.
- F. Test reports as required by provisions of this Section.

CALHOUN COUNTY JAIL
ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
DETENTION MODULE PACKAGE
ANNISTON, ALABAMA

1.4 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of following codes, specifications and standards, except as otherwise indicated:
1. ACI 301, "Specifications for Structural Concrete for Buildings."
 2. ACI 318, "Building Code Requirements for Reinforced Concrete."
 3. AWS D1.1, "Structural Welding Code: Steel."
 4. Concrete Reinforcing Steel Institute, "Manual of Standard Practice."
 5. Prestressed Concrete Institute MNL 116, "Manual for Quality Control for Plants and Production of Precast Concrete Products."
- B. Fabricator Qualifications: Firm experienced in fabrication of precast concrete units similar to units required for this Project and that have a record of successful in-service performance, with sufficient production capacity to produce required units without causing delay in work.
1. Fabricator must be a producer member of the Prestressed Concrete Institute (PCI) and/or participate in its Plant Certification Program.
- C. Design by Fabricator: Design precast slab units to support superimposed dead loads and live loads as indicated on drawings and as required for compliance with local governing code requirements.
- D. Fabrication Qualifications: Produce precast concrete units at fabricating plant engaged primarily in manufacturing of similar units, unless plant fabrication or delivery to Project site is impractical.
1. If units are not produced at precast concrete fabricating plant, maintain procedures and conditions for quality control that are equivalent to plant production.
- E. Fire-Resistance Rated Precast Units: Where precast concrete units are shown or scheduled as requiring fire-resistance classification, provide units tested and listed by Underwriters Laboratories, Inc. (UL) in "Fire Resistance Directory", or with each unit bearing UL label and marking.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver the amount of precast concrete units needed in a timely manner to the Project site to ensure installation continuity.
- B. Store and handle the units at the Project site to prevent cracking, distortion, staining, or other physical damage, and so that markings are visible. Lift and support units at designated lift points.
- C. Deliver anchorage items that are to be embedded in other construction before starting such work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 FORMWORK

CALHOUN COUNTY JAIL
ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
DETENTION MODULE PACKAGE
ANNISTON, ALABAMA

- A. Provide forms and, where required, form facing materials of metal, plastic, wood, or another acceptable material that is nonreactive with concrete and will produce required finish surfaces.
- B. Accurately construct forms, mortar-tight, of sufficient strength to withstand pressures due to concrete placing operations, temperature changes, and for prestressed, pre-tensioning, and detensioning operations. Maintain formwork to provide completed precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified in PCI MNL 116.
- C. Unless forms for plant-manufactured prestressed concrete units are stripped prior to detensioning, design forms so that stresses are not induced in precast units due to deformation of concrete under prestress or movement during detensioning.

2.2 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Low-Alloy Steel Reinforcing Bars: ASTM A 706.
- C. Galvanized Reinforcing Bars: ASTM A 767, Class II (2.0 oz. zinc psf), hot-dip galvanized.
- D. Steel Wire: ASTM A 82, plain, cold-drawn steel.
- E. Welded Wire Fabric: ASTM A 185.
- F. Welded Deformed Steel Wire Fabric: ASTM A 497.
- G. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing, complying with CRSI recommendations.
 - 1. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs that are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).

2.3 PRESTRESSING TENDONS

- A. Uncoated, 7-wire, stress-relieved strand complying with ASTM A 416. Use Grade 250 unless Grade 270 is indicated.
- B. A strand similar to above, but having the size and ultimate strength of wires increased so that the ultimate strength of the strand is increased approximately 15 percent, or a strand with increased strength but fewer number of wires per strand, may be used at manufacturer's option.

2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type III.
- B. Use only one brand and type of cement throughout Project, unless otherwise acceptable to Architect.

CALHOUN COUNTY JAIL
ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
DETENTION MODULE PACKAGE
ANNISTON, ALABAMA

- C. Aggregates: ASTM C 33, and as specified here. Provide aggregates from a single source for exposed concrete.
 - 1. Local aggregates not complying with ASTM C 33, but that have shown by special test or actual service to produce concrete of adequate strength and durability, may be used when acceptable to Architect.
- D. Lightweight Aggregate: ASTM C 330.
- E. Water: Potable.
- F. Admixtures, General: Provide admixtures for concrete that contain not more than 0.1 percent chloride ions.
- G. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- H. Water-Reducing Admixture: ASTM C 494, Type A, or other Type approved for fabricator's units.

2.5 CONNECTION MATERIALS

- A. Steel Plates: Structural quality, hot-rolled carbon steel, ASTM A 283, Grade C.
- B. Steel Shapes: ASTM A 36.
- C. Anchor Bolts: ASTM A 307, low-carbon steel bolts, regular hexagon nuts, and carbon steel washers.
- D. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, and hardened washers complying with ASTM A 325.
- E. Finish of Steel Units: Exposed units galvanized per ASTM A 153; others painted with rust-inhibitive primer.
- F. Bearing Pads: Provide bearing pads for precast concrete units as indicated on drawings.
 - 1. Elastomeric Pads: Vulcanized, chloroprene elastomeric compound, molded to size or cut from a molded sheet, 50-60 shore A durometer.
 - 2. Laminated Fabric-Rubber Pads: Preformed, unused synthetic fibers and new, unvulcanized rubber. Surface hardness of 70-80 shore A durometer.
 - 3. Frictionless Pads: Tetrafluoroethylene (TFE), with glass-fiber reinforcing as required for service load-bearing stress.
 - 4. Tempered Hardboard Pads: Smooth both sides.
- G. Welding Electrodes: Comply with AWS standards.
- H. Accessories: Provide clips, hangers, and other accessories required to install project units and to support subsequent construction or finishes.

2.6 GROUT MATERIALS

CALHOUN COUNTY JAIL
ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
DETENTION MODULE PACKAGE
ANNISTON, ALABAMA

- A. Cement Grout: Portland cement, ASTM C 150 (Type I), and clean, natural sand, ASTM C 404. Mix at ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum water required for placement and hydration.
- B. Metallic Shrinkage-Resistant Grout: Premixed, factory-packaged ferrous aggregate grouting compound complying with ASTM C 1107, Grade B, with fluid consistency and a 30-minute working time.
- C. Nonmetallic Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining product containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with ASTM C 1107, Grade B, with fluid consistency and a 30-minute working time.
- D. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
- E. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Metallic Shrinkage-Resistant Grout:
 - a. 100 Non-Shrink Grout (Metallic), Conspec, Inc.
 - b. Firmix, Euclid Chemical Co.
 - c. Vibra-Foil, W.R. Grace.
 - d. Ferrogout, L & M Construction Chemicals, Inc.
 - e. Embeco 885, Master Builders.
 - f. Portalico, Protex Industries, Inc.
 - g. Kemox G, Sika Chemical.
 - h. Ferrolith G, Sonneborn/Rexnord.
 - 2. Nonmetallic Shrinkage-Resistant Grout:
 - a. 100 Non-Shrink Grout (Non-Metallic), Conspec, Inc.
 - b. Supreme Grout, Cormix, Inc.
 - c. Sure Grip Grout, Dayton Superior.
 - d. Euco N.S., Euclid Chemical Co.
 - e. Crystex, L & M Construction Chemicals.
 - f. Masterflow 928, Master Builders, Inc.
 - g. Sealtight 588 Grout, W.R. Meadows.
 - h. Propak, Protex Industries, Inc.
 - i. Set Non-Shrink, Set Products, Inc.
 - j. Stoncrete NM1, Stonhard, Inc.
 - k. Multi-Purpose Grout, Symons Corp.
 - l. Portland Expanding Grout (Non-Shrink), Target Products, Ltd.
 - m. Five Star Grout, U.S. Grout Corp.

2.7 MIX PROPORTION AND DESIGN

- A. Prepare design mixes for each type of concrete required.

CALHOUN COUNTY JAIL
ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
DETENTION MODULE PACKAGE
ANNISTON, ALABAMA

- B. Design mixes may be prepared by independent testing facility or by qualified precast manufacturing plant personnel at precast manufacturer's option.
- C. Proportion mixes by either laboratory trial batch or field experience methods using materials to be employed on the Project for each type of concrete required complying with ACI 318.
 - 1. Produce standard-weight concrete consisting of specified portland cement, aggregates, admixtures, and water to produce the following properties:
 - a. Compressive strength--5000 psi minimum at 28 days.
 - b. Release strength for prestressed units--3500 psi.
 - 2. Produce lightweight concrete consisting of specified portland cement, aggregates, admixtures, and water to produce the following properties:
 - a. Compressive strength--5000 psi minimum at 28 days.
 - b. Air-dry density--not less than 90 nor more than 115 lb per cu. ft.
 - c. Release strength for prestressed units--3500 psi.
 - 3. Cure compression test cylinders using same methods as for precast concrete work.
- D. Submit written reports to Architect of proposed mix for each type of concrete at least 15 days prior to start of precast unit production. Do not begin concrete production until mixes and evaluations have been reviewed by Architect.
- E. Adjusting Concrete Mixes: Mix design adjustments may be requested when characteristics of materials, job conditions, weather, test results, or other circumstances warrant. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by Architect before using in the Work.
- F. Admixtures: Use air-entraining admixture in concrete, unless otherwise indicated.
 - 1. Use water-reducing admixtures in strict compliance with manufacturer's directions. Admixtures to increase cement dispersion, or provide increased workability for low-slump concrete, may be used subject to Architect's acceptance.
 - 2. Use amounts as recommended by admixture manufacturer for climatic conditions prevailing at time of placing. Adjust quantities of admixtures as required to maintain quality control.

2.8 FABRICATION

- A. General: Fabricate precast concrete units complying with manufacturing and testing procedures, quality control recommendations, and dimensional tolerances of PCI MNL-116 and as specified for types of units required.
- B. Job-Site Casting: Use ready-mix concrete for units produced at a location other than the precast concrete fabricating plant complying with ASTM C 94.
- C. Ready-Mixed Concrete: Comply with requirements of ASTM C 94 and as specified here.

CALHOUN COUNTY JAIL
ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
DETENTION MODULE PACKAGE
ANNISTON, ALABAMA

1. Delete references for allowing additional water to be added to the batch for material with insufficient slump. Adding water to the batch is not permitted.
- D. A shorter mixing time than that specified in ASTM C 94 may be required during hot weather or under conditions contributing to rapidly setting concrete.
1. When the air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes. When air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
- E. Built-in Anchorages: Accurately position built-in anchorage devices and secure to formwork. Locate anchorages where they do not affect the position of the main reinforcement or placing of concrete. Do not relocate bearing plates in units unless acceptable to Architect.
- F. Cast-in openings larger than 10 inches in diameter or 10 inches square in accordance with final shop drawings. Other smaller holes may be field cut by trades requiring them, as acceptable to Architect.
- G. Coat surfaces of forms with bond-breaking compound before reinforcement is placed. Provide commercial formula form-coating compounds that will not bond with, stain, or adversely affect concrete surfaces, and that will not impair subsequent treatments of concrete surfaces requiring bond or adhesion. Apply in compliance with manufacturer's instructions.
- H. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete.
- I. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcement by metal chairs, runners, bolsters, spacers and hangers, as required.
- J. Place reinforcement to obtain at least the minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- K. Pre-tension tendons for prestressed concrete either by single-strand tensioning method or multiple-strand tensioning method. Comply with PCI MNL-116 requirements.
- L. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast units, complying with requirements of ACI 304. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items.
- M. Identify pick-up points and orientation in structure with permanent markings, complying with markings indicated on final shop drawings. Imprint casting date on each precast unit on a surface that will not show in the finished structure.
- N. Cure by low-pressure steam, steam vapor, radiant heat and moisture, or another similar process to accelerate concrete hardening and to reduce curing time.
- O. Delay detensioning prestressed units until concrete has attained at least 70 percent of the design stress, as established by test cylinders.

CALHOUN COUNTY JAIL
ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
DETENTION MODULE PACKAGE
ANNISTON, ALABAMA

1. If concrete has been heat-cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
 2. Detension pre-tensioned tendons either by gradually releasing tensioning jacks or by heat-cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
- P. Finish formed surfaces of precast concrete as indicated for each type of unit, and as follows:
1. Standard Finish: Normal plant-run finish produced in forms that impart a smooth finish to concrete. Small surface holes caused by air bubbles, normal color variations and form joint marks, and minor chips and spalls will be tolerated. Major or unsightly imperfections, honeycomb, or structural defects are not permitted.
 2. Commercial Finish: Remove fins and large protrusions and fill large holes. Rub or grind ragged edges. Faces are to be true, well-defined surfaces.
- Q. Finish unformed surfaces by trowel unless otherwise indicated. Consolidate concrete, bring to proper level with straightedge, float, and trowel to a smooth uniform finish.
1. Apply scratch finish to precast units that will receive concrete topping after installation. Following initial strikeoff, transversely scarify surface to provide ridges approximately 1/4-inch deep.

2.9 HOLLOW SLAB UNITS

- A. Type: Precast, prestressed concrete units with open voids running full length of slabs.
- B. Furnish units that are free of voids or honeycomb, with straight true edges and surfaces.
- C. Provide standard finish units unless otherwise indicated.
- D. Fabricate units of concrete materials that will provide a minimum 3500 psi compressive strength at the time of initial prestress and a 28-day compressive strength of 5000 psi.
- E. Adequately reinforce slab units to resist transportation and handling stresses.
- F. Include cast-in weld plates where required for anchorage or lateral bracing to structural steel members.
- G. Coordinate with other trades for installation of items to be cast-in hollow slab units.
- H. Provide solid, monolithic precast slab units indicated to be an integral part of hollow slab unit system. Design and fabricate solid units to dimensions and details indicated as specified for hollow slab units.
- I. Provide headers of cast-in-place concrete or structural steel shapes for openings larger than one slab width in accordance with hollow slab unit manufacturer's recommendations.

CALHOUN COUNTY JAIL
ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
DETENTION MODULE PACKAGE
ANNISTON, ALABAMA

2.10 STRUCTURAL FRAMING UNITS

- A. Type: Precast, prestressed concrete units produced under a rigidly inspected process.
- B. Furnish units that are free of voids or honeycomb, with straight true edges and surfaces.
- C. Provide standard finish units as specified.
- D. Where ends of strands will not be enclosed or covered, cut flush and cover with a high strength mortar bonded with an epoxy resin bonding agent.
- E. Fabricate units of concrete materials that will provide a minimum 3500 psi compressive strength at the time of initial prestress and a 28-day strength of 5000 psi.
- F. Adequately reinforce units to resist transporting and handling stresses.
- G. Include cast-in weld plates where required for anchorage or lateral bracing to other supporting members.
- H. Coordinate with other trades for the installation of items to be cast-in precast structural framing units.

2.11 SOURCE QUALITY CONTROL

- A. The Owner may employ an independent testing laboratory to evaluate precast manufacturer's quality control and testing methods.
- B. The precast manufacturer shall allow Owner's testing facility access to materials storage areas, concrete production equipment, and concrete placement and curing facilities. Cooperate with Owner's testing laboratory and provide samples of materials and concrete mixes as may be requested for additional testing and evaluation.
- C. Dimensional Tolerances: Units having dimensions smaller or greater than required and outside specified tolerance limits may be subject to additional testing as specified here.
- D. Precast units having dimensions greater than required will be rejected if the appearance or function of the structure is adversely affected or if larger dimensions interfere with other construction. Repair or remove and replace rejected units, as required, to meet construction conditions.
- E. Strength of precast concrete units will be considered potentially deficient if the manufacturing processes fail to comply with any of the requirements that may affect the strength of the precast units, including the following conditions:
 - 1. Failure to meet compressive strength tests requirements.
 - 2. Reinforcement, and pre-tensioning and detensioning tendons of prestressed concrete not conforming to specified fabrication requirements.
 - 3. Concrete curing, and protection of precast units against extremes in temperature not as specified.
 - 4. Precast units damaged during handling and erection.

CALHOUN COUNTY JAIL
ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
DETENTION MODULE PACKAGE
ANNISTON, ALABAMA

- F. Testing Precast Units: When there is evidence that the strength of precast concrete units may not meet specification requirements, the Owner's testing laboratory will take cores drilled from hardened concrete for compressive strength determination, complying with ASTM C 42 and as follows:
1. Take at least three representative cores from precast units of suspect strength, from locations directed by Architect.
 2. Test cores in a saturated-surface-dry condition per ACI 318 if concrete will be wet when using completed structure.
 3. Test cores in an air-dry condition per ACI 318 if concrete will be dry when using completed structure.
 4. Strength of concrete for each series of cores will be considered satisfactory if the average compressive strength is at least 85 percent of 28-day design compressive strength.
 5. Test results will be made in writing on the same day that tests are made, with copies to Architect, General Contractor, and precast manufacturer. Include in the test reports the Project identification name and number, date, name of precast concrete manufacturer, name of concrete testing laboratory; identification letter, name, and type of member or members represented by core tests; design compressive strength, compression breaking strength and type of break (corrected for length-diameter ratio), and direction of applied load to core with respect to horizontal plane of concrete as placed.
- G. Patching: Where core test results are satisfactory and precast units are acceptable for use in Work, solidly fill core holes with patching mortar and finish to match adjacent concrete surfaces.
- H. Defective Work: Remove precast concrete units that do not conform to specified requirements, including strength, tolerances, and finishes. Replace with precast concrete units that meet requirements of this section.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Bearing Pads: Install flexible bearing pads where indicated as precast units are being erected. Set pads on level, uniform bearing surfaces and maintain in correct position until precast units are placed.
- B. Welding: Perform welding in compliance with AWS D 1.1 and D 1.4, including qualification of welders.
1. Protect units from damage by field welding or cutting operations and provide non-combustible shield as required.
 2. Repair damaged metal surfaces by cleaning and applying a coat of liquid galvanizing repair compound to galvanized surfaces and a compatible primer to painted surfaces.
- C. Powder-Actuated Fasteners: Do not use powder-actuated fasteners for attaching accessory items to the surface of a precast, prestressed unit unless otherwise accepted by precast manufacturer.
- D. Erection Tolerances: Install precast units without exceeding tolerance limits specified in PCI MNL-127, "Recommended Practice for Erection of Precast Concrete."

CALHOUN COUNTY JAIL
ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
DETENTION MODULE PACKAGE
ANNISTON, ALABAMA

1. Grouting Connections and Joints: After precast concrete units have been placed and secured, grout open spaces at connection and joints as follows:
2. Cement grout consisting of 1 part portland cement, 2-1/2 parts sand, and only enough water to properly mix and hydrate.
3. Shrinkage-resistant grout consisting of premixed compound and water to provide a flowable mixture without segregation or bleeding.
4. Provide forms or other acceptable method to retain grout in place until sufficiently hard to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, plumb, and level with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it hardens.

END OF SECTION 03 41 0

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 3 CONCRETE
Section 03 45 00 Plant – Precast Architectural Concrete

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section

1.2 SUMMARY

- A. This Section includes the following:

- 1. Precast architectural concrete units.

- B. Related Sections include the following:

- 1. Division 3 Section "Glass-Fiber-Reinforced Concrete."
 - 2. Division 4 Section "Cast Stone" for wet or dry cast stone facings, trim, and accessories.
 - 3. Division 4 Section "Unit Masonry Assemblies" for full-size brick facing, mortar, and anchorages.
 - 4. Division 7 Section "Water Repellents" for water-repellent finish treatments.
 - 5. Division 7 Section "Sheet Metal Flashing and Trim" for flashing receivers and reglets.
 - 6. Division 7 Section "Joint Sealants" for elastomeric joint sealants and sealant backings.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide precast architectural concrete units and connections capable of withstanding design loads within limits and under conditions indicated.

- B. Structural Performance: Provide precast architectural concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:

- 1. Dead Loads: Per Manufacturer's Criteria.
 - 2. Live Loads: 20 P.S.F.
 - 3. Wind Loads: As required to meet 1997 Standard Building Code criteria for 80 mph wind velocity.
 - 4. Earthquake Loads: Design shall meet requirements of 1997 Standard Building Code for Seismic, Hazard exposure, Group II, Acceleration Coefficient (Av) .10, Peak Acceleration Coefficient (Aa) .10, Site Coefficient (S) 1.00.
 - 5. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

- a. Upward and downward movement of 1/2 inch (13 mm).

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Design Mixes: For each concrete mix.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- C. Shop Drawings: Detail fabrication and installation of precast architectural concrete units. Indicate member locations, plans, elevations, dimensions, shapes, cross sections, limits of each finish, and types of reinforcement, including special reinforcement.
 - 1. Indicate separate face and backup mix locations and thicknesses.
 - 2. Indicate locations and extent and treatment of dry joints if two-stage casting is proposed.
 - 3. Indicate welded connections by AWS standard symbols. Detail loose and cast-in hardware, inserts, connections, and joints, including accessories.
 - 4. Indicate locations and details of anchorage devices to be embedded in other construction.
 - 5. Comprehensive engineering analysis signed and sealed by the qualified professional engineer responsible for its preparation.
- D. Samples: For each type of finish indicated on exposed surfaces of precast architectural concrete units, in sets of 3, illustrating full range of finish, color, and texture variations expected; approximately 12 by 12 by 2 inches (300 by 300 by 50 mm).
- E. Welding Certificates: Copies of certificates for welding procedures and personnel.
- F. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- G. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:
- H. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
 - 1. Concrete materials.
 - 2. Reinforcing materials and prestressing tendons.
 - 3. Admixtures.
 - 4. Bearing pads.
 - 5. Water-absorption test reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed precast architectural concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Fabricator Qualifications: A firm that complies with the following requirements and is experienced in manufacturing precast architectural concrete units similar to those indicated for this Project and with a record of successful in-service performance.
 - 1. Assumes responsibility for engineering precast architectural concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
 - 2. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of precast architectural concrete that are similar to those indicated for this Project in material, design, and extent.
 - 3. Participates in PCI's Plant Certification program and is designated a PCI-certified plant for Group A, Category A1--Architectural Cladding and Load Bearing Units or in APA's Plant

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- Certification Program for Production of Architectural Precast Concrete Products and is designated an APA-certified plant.
4. Has sufficient production capacity to produce required units without delaying the Work.
 5. Is registered with and approved by authorities having jurisdiction.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, the Owner and the owner's representative, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
- D. Design Standards: Comply with ACI 318 (ACI 318M) and the design recommendations of PCI MNL 120, "PCI Design Handbook--Precast and Prestressed Concrete."
- E. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."
- F. Product Options: Drawings indicate size, profiles, and dimensional requirements of precast concrete units and are based on the specific types of units indicated. Other fabricators' precast concrete units complying with requirements may be considered. Refer to Division 1 Section "Substitutions."
- G. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel"; and AWS D1.4, "Structural Welding Code--Reinforcing Steel."
- H. Calculated Fire-Test-Response Characteristics: Where indicated, provide precast architectural concrete units whose fire resistance has been calculated according to PCI MNL 124, "Design for Fire Resistance of Precast Prestressed Concrete," or ACI 216.1/TMS 0216.1, "Standard Method for Determining Fire Resistance of Concrete and Masonry Construction Assemblies," and is acceptable to authorities having jurisdiction.
- I. Sample Panels: Before fabricating precast architectural concrete units, produce sample panels to establish the approved range of selections made under sample Submittals. Produce a minimum of 3 sets of full-scale sample panels, approximately 48 inches (1200 mm) long by 48 inches (1200 mm) high, to demonstrate the expected range of finish, color, and texture variations.
1. Locate panels where indicated or, if not indicated, as directed by Architect.
 2. In presence of Architect, damage part of an exposed-face surface for each finish, color, and texture, and demonstrate materials and techniques proposed for repair of surface blemishes to match adjacent undamaged surfaces.
 3. Maintain sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
 4. Demolish and remove sample panels when directed.
- J. Mockups: Before installing precast architectural concrete units, build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect or the Owner.
 2. Notify Architect and the Owner's representative seven days in advance of dates and times when mockups will be constructed.
 3. Obtain Architect's approval of mockups before starting fabrication.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

4. In presence of Architect, damage part of an exposed face for each finish, color, and texture, and demonstrate materials and techniques proposed for repairs to match adjacent undamaged surfaces.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed.
7. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

- K. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver precast architectural concrete units to Project site in such quantities and at such times to ensure continuity of installation. Store units at Project site to prevent cracking, distorting, warping, staining, or other physical damage, and so markings are visible.
- B. Lift and support units only at designated lifting and supporting points as shown on Shop Drawings.

1.7 SEQUENCING

- A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 FABRICATORS

- A. Available Fabricators: Subject to compliance with requirements, fabricators offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Fabricators: Subject to compliance with requirements, provide products by one of the following:
 1. Miller Precast Columbus, GA
 2. Columbia Precast LLC, Columbia, TN
 3. Castone Corp., Opelika, AL

Equal concrete precasters belonging to the Architectural Precast Association, Ft. Myers, FL will be acceptable equals to complete compliance with these specifications.

2.2 MOLD MATERIALS

- A. Molds: Provide molds and, where required, form-facing materials of metal, plastic, wood, or another material that is nonreactive with concrete and dimensionally stable to produce continuous and true precast concrete surfaces within fabrication tolerances and suitable for required finishes
- B. Form Liners: Units of face design, texture, arrangement, and configuration indicated.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2.3 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- C. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized after fabrication and bending, as follows:
 - 1. Steel Reinforcement: ASTM A 615/A 615M, Grade 60 (Grade 420) or ASTM A 706/A 706M, deformed.
- D. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M, as follows:
 - 1. Steel Reinforcement: ASTM A 615/A 615M, Grade 60 (Grade 420) or ASTM A 706/A 706M, deformed.
- E. Steel Bar Mats: ASTM A 184/A 184M, assembled with clips, as follows:
 - 1. Steel Reinforcement: ASTM A 615/A 615M, Grade 60 (Grade 420) or ASTM A 706/A 706M, deformed bars.
- F. Plain-Steel Wire: ASTM A 82, galvanized.
- G. Deformed-Steel Wire: ASTM A 496.
- H. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A coated, plain or deformed.
- I. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from galvanized steel wire into flat sheets.
- J. Deformed-Steel Welded Wire Fabric: ASTM A 497, flat sheet.
- K. Epoxy-Coated-Steel Welded Wire Fabric: ASTM A 884/A 884M, Class A coated, plain or deformed.
- L. Supports: Manufacturer's bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place according to CRSI's "Manual of Standard Practice," PCI MNL 117, and as follows:
 - 1. For uncoated reinforcement, use all-plastic, CRSI Class 1 plastic-protected, or CRSI Class 2 stainless-steel bar supports.
 - 2. For epoxy-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire or all-plastic bar supports.
 - 3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire or all-plastic bar supports.

2.4 PRESTRESSING TENDONS

- A. Prestressing Strand: ASTM A 416/A 416M, Grade 250 or 270 (Grade 1725 or 1860), uncoated, 7-wire, low-relaxation strand.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2.5 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type III, white, of same type, brand, and source.
 - 1. Standard gray portland cement may be used for nonexposed backup concrete.
- B. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33, with coarse aggregates complying with Class 5S.
 - 1. Face-Mix Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining.
 - a. Gradation: To match design reference sample.
 - 2. Face-Mix Fine Aggregates: Selected, natural or manufactured sand of the same material as coarse aggregate, unless otherwise approved by Architect.
- C. Lightweight Aggregates: ASTM C 330.
- D. Coloring Admixture: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures, temperature stable, nonfading, and alkali resistant.
- E. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.
- F. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- G. Water-Reducing Admixture: ASTM C 494, Type A.
- H. Retarding Admixture: ASTM C 494, Type B.
- I. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
- J. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
- K. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
- L. Plasticizing Admixture: ASTM C 1017.
- M. Fly Ash Admixture: ASTM C 618, Class C or F.
- N. Metakaolin Admixture: ASTM C 618, Class N.
- O. Silica Fume Admixture: ASTM C 1240.

2.6 STEEL CONNECTION MATERIALS

- A. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.
- B. Carbon-Steel Headed Studs: ASTM A 108, AISI 1018 through AISI 1020, cold finished; AWS D1.1, Type A or B, with arc shields.
- C. Carbon-Steel Plate: ASTM A 283/A 283M.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- D. Malleable Steel Castings: ASTM A 47 (ASTM A 47M).
- E. Carbon-Steel Castings: ASTM A 27/A 27M, Grade 60-30 (Grade 415-205).
- F. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M.
- G. Carbon-Steel Structural Tubing: ASTM A 500, Grade B.
- H. Wrought Carbon-Steel Bars: ASTM A 675/A 675M, Grade 65 (Grade 450).
- I. Deformed-Steel Wire or Bar Anchors: ASTM A 496 or ASTM A 706/A 706M.
- J. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); carbon-steel, hex-head bolts and studs; carbon-steel nuts; and flat, unhardened steel washers.
- K. High-Strength Bolts and Nuts: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.
- L. Finish: For exterior steel items, steel in exterior walls, and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123/A 123M, after fabrication, and ASTM A 153/A 153M, as applicable or electrodeposition according to ASTM B 633, SC 3.
 - 1. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035A or SSPC-Paint 20.
- M. Shop-Primed Finish: Prepare surfaces of nongalvanized steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3 and shop-apply lead- and chromate-free, rust-inhibitive primer, complying with performance requirements in FS TT-P-664 or SSPC-Paint 25 according to SSPC-PA 1.
- N. Reglets: PVC extrusions, Stainless steel, or Copper.
- O. Welding Electrodes: Comply with AWS standards.
- P. Accessories: Provide clips, hangers, plastic shims, and other accessories required to install precast architectural concrete units.

2.7 STAINLESS-STEEL CONNECTION MATERIALS

- A. Stainless-Steel Plate: ASTM A 666, Type 304, of grade suitable for application.
- B. Stainless-Steel Bolts and Studs: ASTM F 593, alloy 304 or 316, hex-head bolts and studs; stainless-steel nuts; and flat, stainless-steel washers.
- C. Stainless-Steel Headed Studs: ASTM A 276.

2.8 BEARING PADS

- A. Provide bearing pads for precast architectural concrete units as follows:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore A durometer, minimum tensile strength **2250 psi (15.5 MPa)** per ASTM D 412.
2. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Surface hardness of 70 to 90 Shore A durometer.
3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer. Surface hardness of 80 to 100 Shore A durometer.
4. Frictionless Pads: Tetrafluoroethylene, glass-fiber reinforced, bonded to mild-steel plate, of type required for in-service stress.
5. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

2.9 GROUT MATERIALS

- A. Sand-Cement Grout: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 144. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, of consistency suitable for application.

2.10 CONCRETE MIXES

- A. Prepare design mixes for each type of concrete required.
 1. Limit use of fly ash and silica fume to not exceed, in aggregate, 25 percent of portland cement by weight.
- B. Design mixes may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast architectural concrete fabricator's option.
- C. Limit water-soluble chloride ions to the maximum percentage by weight of cement permitted by ACI 318 (ACI 318M).
- D. Normal-Weight Concrete Face and Backup Mixes: Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
 1. Compressive Strength (28 Days): 5000 psi (34.5 MPa).
 2. Maximum Water-Cementitious Materials Ratio: 0.45.
- E. Water Absorption: 12 to 14 percent by volume, tested according to PCI MNL 117.
- F. Lightweight Concrete Backup Mixes: Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.2, with materials to be used on Project, to provide lightweight concrete with the following properties:
 1. Compressive Strength (28 Days): 5000 psi (34.5 MPa).
 2. Unit Weight: Calculated equilibrium unit weight of 115 lb/cu. ft. (1842 kg/cu. m), plus or minus 3 lb/cu. ft. (48 kg/cu. m), according to ASTM C 567.
- G. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- H. When included in design mixes, add other admixtures to concrete mixes according to manufacturer's written instructions.

2.11 MOLD FABRICATION

- A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing operations.
 - 1. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during concreting. Coat form liner with form-release agent.
- B. Maintain molds to provide completed precast architectural concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
 - 1. Edge and Corner Treatment: Uniformly radiused.

2.12 FABRICATION

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
- B. Furnish loose steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing precast architectural concrete units to supporting and adjacent construction.
- C. Cast-in reglets, slots, holes, and other accessories in precast architectural concrete units to receive windows, cramps, dowels, reglets, waterstops, flashings, and other similar work as indicated.
- D. Cast-in openings larger than 10 inches (250 mm) in any dimension.
- E. Reinforcement: Comply with recommendations in CRSI's "Manual of Standard Practice" and PCI MNL 117 for fabricating, placing, and supporting reinforcement.
 - 1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete.
 - 2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
 - 3. Place reinforcement to maintain at least 3/4-inch (19-mm) minimum coverage. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
 - 4. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- F. Reinforce precast architectural concrete units to resist handling, transportation, and erection stresses.
- G. Prestress tendons for precast architectural concrete units by either pretensioning or posttensioning methods. Comply with PCI MNL 117.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Delay detensioning or posttensioning of precast, prestressed architectural concrete units until concrete has reached its indicated minimum design release compressive strength as established by test cylinders cured under the same conditions as concrete.
- H. Mix concrete according to PCI MNL 117 and requirements in this Section. After concrete batching, no additional water may be added.
- I. Place face mix to a minimum thickness after consolidation of the greater of 1 inch (25 mm) or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover.
- J. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units. Comply with requirements in PCI MNL 117 for measuring, mixing, transporting, and placing concrete.
 1. Place backup concrete to ensure bond with face mix concrete.
- K. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with PCI MNL 117.
- L. Comply with ACI 306.1 procedures for cold-weather concrete placement.
- M. Comply with ACI 305R recommendations for hot-weather concrete placement.
- N. Identify pickup points of precast architectural concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast architectural concrete unit on a surface that will not show in finished structure.
- O. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture.
- P. Discard precast architectural concrete units that are warped, cracked, broken, spalled, stained, or otherwise defective unless repairs are approved by Architect.

2.13 FABRICATION TOLERANCES

- A. Fabricate precast architectural concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished panel complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.
- B. Fabricate precast architectural concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished panel complies with the following product tolerances:
 1. Overall Height and Width of Units, Measured at the Face Exposed to View: As follows:
 - a. 10 feet (3 m) or under, plus or minus 1/8 inch (3 mm).
 - b. 10 to 20 feet (3 to 6 m), plus 1/8 inch (3 mm), minus 3/16 inch (5 mm).
 - c. 20 to 40 feet (6 to 12 m), plus or minus 1/4 inch (6 mm).
 - d. Each additional 10 feet (3 m), plus or minus 1/16 inch (1.5 mm).
 2. Overall Height and Width of Units, Measured at the Face Not Exposed to View: As follows:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. 10 feet (3 m) or under, plus or minus 1/4 inch (6 mm).
 - b. 10 to 20 feet (3 to 6 m), plus 1/4 inch (6 mm), minus 3/8 inch (10 mm).
 - c. 20 to 40 feet (6 to 12 m), plus or minus 3/8 inch (10 mm).
 - d. Each additional 10 feet (3 m), plus or minus 1/8 inch (3 mm).
3. Total Thickness or Flange Thickness: Plus 1/4 inch (6 mm), minus 1/8 inch (3 mm).
 4. Rib Thickness: Plus or minus 1/8 inch (3 mm).
 5. Rib to Edge of Flange: Plus or minus 1/8 inch (3 mm).
 6. Distance between Ribs: Plus or minus 1/8 inch (3 mm).
 7. Variation from Square or Designated Skew (Difference in Length of the Two Diagonal Measurements): Plus or minus 1/8 inch per 72 inches (3 mm per 2 m) or 1/2 inch (13 mm) total, whichever is greater.
 8. Length and Width of Block-outs and Openings within One Unit: Plus or minus 1/4 inch (6 mm).
 9. Location and Dimension of Block-outs Hidden from View and Used for HVAC and Utility Penetrations: Plus or minus 3/4 inch (19 mm).
 10. Dimensions of Haunches: Plus or minus 1/4 inch (6 mm).
 11. Haunch Bearing Surface Deviation from Specified Plane: Plus or minus 1/8 inch (3 mm).
 12. Difference in Relative Position of Adjacent Haunch Bearing Surfaces from Specified Relative Position: Plus or minus 1/4 inch (6 mm).
 13. Bowing: Plus or minus L/360, maximum 1 inch (25 mm).
 14. Local Smoothness: 1/4 inch per 10 feet (6 mm per 3 m).
 15. Variation between Adjacent Thin-Brick-Facing Products: 1/16 inch (2 mm).
 16. Warping: 1/16 inch per 12 inches (1.5 mm per 300 mm) of distance from the nearest adjacent corner.
 17. Tipping and Flushness of Plates: Plus or minus 1/4 inch (6 mm).
 18. Dimensions of Architectural Features and Rustications: Plus or minus 1/8 inch (3 mm).
- C. Position Tolerances: For cast-in items measured from datum line location, as indicated on Shop Drawings.
1. Weld Plates: Plus or minus 1 inch (25 mm).
 2. Inserts: Plus or minus 1/2 inch (13 mm).
 3. Handling Devices: Plus or minus 3 inches (75 mm).
 4. Reinforcing Steel and Welded Wire Fabric: Plus or minus 1/4 inch (6 mm) where position has structural implications or affects concrete cover; otherwise, plus or minus 1/2 inch (13 mm).
 5. Reinforcing Steel Extending out of Member: Plus or minus 1/2 inch (13 mm) of plan dimensions.
 6. Tendons: Plus or minus 1/4 inch (6 mm), vertical; plus or minus 1 inch (25 mm), horizontal.
 7. Location of Rustication Joints: Plus or minus 1/8 inch (3 mm).
 8. Location of Opening within Panel: Plus or minus 1/4 inch (6 mm).
 9. Flashing Reglets: Plus or minus 1/4 inch (6 mm).
 10. Flashing Reglets at Edge of Panel: Plus or minus 1/8 inch (3 mm).
 11. Reglets for Glazing Gaskets: Plus or minus 1/8 inch (3 mm).
 12. Electrical Outlets, Hose Bibs: Plus or minus 1/2 inch (13 mm).
 13. Haunches: Plus or minus 1/4 inch (6 mm).
 14. Allowable Rotation of Plate, Channel Inserts, Electrical Boxes: 2-degree rotation or 1/4 inch (6 mm) maximum over the full dimension of the unit.

2.14 FINISHES

- A. Finish exposed-face surfaces of precast architectural concrete units to match approved design reference sample and as follows:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Design Reference Sample: As selected from manufacturer's standard colors.
 2. PCI and APA's "Architectural Precast Concrete--Color and Texture Selection Guide," of plate numbers indicated.
 3. Smooth-Surface Limestone Finish: Provide surfaces free of pockets, sand streaks, and honeycombs, with uniform color and texture. (Match existing limestone as close as possible.)
- B. Finish exposed top and bottom surfaces of precast architectural concrete units to match face-surface finish. No Exceptions.
- C. Finish exposed top and bottom surfaces of precast architectural concrete units by smooth, steel-trowel finish.
- D. Finish unexposed surfaces of precast architectural concrete units by float finish.

2.15 SOURCE QUALITY CONTROL

- A. Owner will employ an independent testing agency to evaluate precast architectural concrete fabricator's quality-control and testing methods.
1. Allow Owner's testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with Owner's testing agency and provide samples of materials and concrete mixes as may be requested for additional testing and evaluation.
- B. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements.
- C. Strength of precast concrete units will be considered deficient if units fail to comply with ACI 318 (ACI 318M) requirements.
- D. Testing: If there is evidence that the strength of precast concrete units may be deficient or may not comply with ACI 318 (ACI 318M) requirements, Owner will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42.
1. A minimum of three representative cores will be taken from units of suspect strength, from locations directed by Architect.
 2. Cores will be tested in an air-dry condition.
 3. Strength of concrete for each series of 3 cores will be considered satisfactory if the average compressive strength is equal to at least 85 percent of the 28-day design compressive strength and no single core is less than 75 percent of the 28-day design compressive strength.
 4. Test results will be made in writing on the same day that tests are performed, with copies to Architect, Contractor, and precast concrete fabricator. Test reports will include the following:
 - a. Project identification name and number.
 - b. Date when tests were performed.
 - c. Name of precast concrete fabricator.
 - d. Name of concrete testing agency.
 - e. Identification letter, name, and type of precast concrete unit or units represented by core tests; design compressive strength; type of break; compressive strength at

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.

- E. Patching: If core test results are satisfactory and precast concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mix that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.
- F. Defective Work: Precast architectural concrete units that do not comply with requirements, including strength, manufacturing tolerances, and finishes, are unacceptable. Replace with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Do not install precast concrete units until supporting concrete has attained minimum design compressive strength.

3.2 INSTALLATION

- A. Install clips, hangers, and other accessories required for connecting precast architectural concrete units to supporting members and backup materials.
- B. Install precast architectural concrete. Provide temporary supports and bracing as required to maintain position, stability, and alignment as units are being permanently connected.
 - 1. Install bearing pads as precast concrete units are being erected.
 - 2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 - 3. Remove projecting hoisting devices and use sand-cement grout to fill voids within recessed hoisting devices flush with surface of concrete.
- C. Anchor precast architectural concrete units in position by bolting, welding, grouting, or as otherwise indicated. Remove temporary shims, wedges, and spacers as soon as possible after anchoring and grouting are completed.
- D. Welding: Perform welding in compliance with AWS D1.1 and AWS D1.4, with qualified welders.
 - 1. Protect precast architectural concrete units and bearing pads from damage by field welding or cutting operations and provide noncombustible shields as required.
 - 2. Repair damaged steel surfaces by cleaning and applying a coat of galvanizing repair paint to galvanized surfaces.
 - 3. Repair damaged steel surfaces by cleaning and repriming damaged painted surfaces.
- E. At bolted connections, use lock washers or other acceptable means to prevent loosening of nuts.
- F. Grouting Connections: Grout connections where required or indicated. Retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.

3.3 ERECTION TOLERANCES

- A. Install precast architectural concrete units level, plumb, square, true, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.
- B. Install precast architectural concrete units level, plumb, square, and true, without exceeding the following noncumulative erection tolerances.
 - 1. Plan Location from Building Grid Datum: Plus or minus 1/2 inch (13 mm).
 - 2. Plan Location from Centerline of Steel: Plus or minus 1/2 inch (13 mm).
 - 3. Top Elevation from Nominal Top Elevation: As follows:
 - a. Exposed Individual Panel: Plus or minus 1/4 inch (6 mm).
 - b. Nonexposed Individual Panel: Plus or minus 1/2 inch (13 mm).
 - c. Exposed Panel Relative to Adjacent Panel: 1/4 inch (6 mm).
 - d. Nonexposed Panel Relative to Adjacent Panel: 1/2 inch (13 mm).
 - 4. Support Elevation from Nominal Support Elevation: As follows:
 - a. Maximum Low: 1/2 inch (13 mm).
 - b. Maximum High: 1/4 inch (6 mm).
 - 5. Maximum Plumb Variation over the Lesser of Height of Structure or 100 Feet (30 m): 1 inch (25 mm).
 - 6. Plumb in Any 10 Feet (3 m) of Element Height: 1/4 inch (6 mm).
 - 7. Maximum Jog in Alignment of Matching Edges: 1/4 inch (6 mm).
 - 8. Joint Width (Governs over Joint Taper): Plus or minus 1/4 inch (6 mm).
 - 9. Maximum Joint Taper: 3/8 inch (10 mm).
 - 10. Joint Taper in 10 Feet (3 m): 1/4 inch (6 mm).
 - 11. Maximum Jog in Alignment of Matching Faces: 1/4 inch (6 mm).
 - 12. Differential Bowing or Camber, as Erected, between Adjacent Members of Same Design: 1/4 inch (6 mm).

3.4 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections.
- B. Field welds and connections using high-strength bolts will be subject to tests and inspections.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 REPAIRS

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Repair exposed exterior surfaces of precast architectural concrete units to match color, texture, and uniformity of surrounding precast architectural concrete if permitted by Architect.
- B. Remove and replace damaged precast architectural concrete units if repairs do not comply with requirements.

3.6 CLEANING

- A. Clean exposed surfaces of precast concrete units after erection to remove weld marks, other markings, dirt, and stains.
 - 1. Wash and rinse according to precast concrete fabricator's written recommendations. Protect other work from staining or damage due to cleaning operations.
 - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes.

END OF SECTION 03 45 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 03 00 00: CONCRETE
Section 03 62 13: Grout and Epoxy

PART 1 – GENERAL- Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section

1.1 SECTION INCLUDES

- A. Section includes non-shrink grout under base plates, bearing plates, handrail pockets, and where specified in Contract Documents.
- B. Section includes Epoxy Injection Adhesive Anchoring System for setting vault anchor bolts.

1.2 RELATED SECTIONS

- A. Section 01310 - Structural Submittals.
- B. Section 01410 - Structural Testing/Inspection Agency Services.

1.3 REFERENCES

- A. ASTM C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens).
- B. ASTM C1107 - Standard Specification For Packaged Dry, Hydraulic-Cement Grout (Non-Shrink).

1.4 QUALITY ASSURANCE

- A. Structural Testing/Inspection Agency shall perform the following quality related items:
 - 1. Perform compressive strength tests in accordance with ASTM C109 with 2-inch x 2-inch cubes. Test one cube at three days, two cubes at seven days and three cubes at 28 days. Perform one compressive strength test for each ten bags of grout used and/or perform one test minimum for each day of grouting, whichever is more frequent.

1.5 SUBMITTALS

- A. Submit product data sheets for review.

PART 2 - PRODUCTS

2.1 GROUT

- A. Provide a non-shrink, non-metallic grout that complies with ASTM C1107.
- B. Grout shall have a minimum compressive strength of 5000 psi at 28 days.
- C. Grout placed in exterior exposed conditions or areas subject to moisture shall be free of gypsum. Grout shall be SikaGrout 212 by Sika, General-Purpose by Symons Dayton Superior, or approved equal.

2.2 WATER
GROUT AND EPOXY

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Provide clean, potable water.

2.3 Epoxy Injection Adhesive Anchoring System

- A. Pure50+ by Dewalt (Basis of Design) or approved equivalent. ASTM 881 and AASHTO M235, Types I, II, IV and V, Grade 3, Classes B & C.

PART 3 - EXECUTION

3.1 HANDLING

- A. Store and protect non-shrink grout from moisture and contamination.

3.2 PREPARATION

- A. Remove mud, dirt and other foreign materials from areas to be grouted.
- B. Apply grout to rough concrete surface; roughen concrete as necessary prior to placing grout.

3.3 MIXING

- A. Mix grout to its fluid, self-leveling consistency in accordance with manufacturer's recommendations. Do not retemper grout. Do not exceed manufacturer's maximum limit on water content or use at a consistency which produces free bleeding. Mix grout in a paddle-type mortar mixer. Do not mix by hand.

3.4 PLACEMENT

- A. Consolidate grout to provide uniformity. Do not vibrate grout.
- B. Use forms to contain grout.

3.5 PROTECTION

- A. Protect grout and areas to be grouted from excessive heat and cold in accordance with manufacturer's specifications. Protect grout from excessive drying shrinkage resulting from wind or direct sunlight. Protect areas grouted from excessive vibrations for three days.

END OF SECTION 03 62 13

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 4: MASONRY
Section 04 01 20.52 Masonry Cleaning

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section

1.2 DESCRIPTION OF WORK:

- A. Extent of masonry restoration work is indicated on drawings and in schedules.
- B. Masonry construction is specified in other Division-4 sections.
- C. Liquid water repellent is specified in a Division-7 section.
- D. Joint sealers are specified in a Division-7 section.

1.3 QUALITY ASSURANCE:

- A. Cleaning Specialist: Work must be performed by a firm having not less than 5 years successful experience in comparable masonry cleaning projects and employing personnel skilled in the cleaning processes and operations indicated.
- B. Cleaning: Demonstrate materials and methods to be used for cleaning each type of masonry surface and condition on sample panels of approximately 25 sq. ft. in area.
 - a. Test adjacent non-masonry materials for possible reaction with cleaning materials.
 - b. Allow waiting period of duration indicated, but not less than 7 calendar days, after completion of sample cleaning to permit study of sample panels for negative reactions.

Repointing: Prepare 2 separate sample areas of approximately 3' high by 6' wide for each type of repointing required, one for demonstrating methods and quality of workmanship expected in removal of mortar from joints and the other for demonstrating quality of materials and workmanship expected in pointing mortar joints.

- C. Concrete Slab Protection – Masonry Contractor in concert shall protect the finish floor slab with appropriate methods to include sanding of concrete floor slab along masonry wall construction a minimum of 2'-0" outside of concrete masonry wall face each side. Failure to meet this requirement will require the General Contractor to fully remediate all unsightly stained conditions.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical data for each product indicated including

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

recommendations for their application and use. Include test reports and certifications substantiating that products comply with requirements.

- B. Restoration Program: Submit written program for each phase of restoration process including protection of surrounding materials on building and site during operations. Describe in detail materials, methods, and equipment to be used for each phase of restoration work.
 - 1. If alternative methods and materials to those indicated are proposed for any phase of restoration work, provide written description, including evidence of successful use on other, comparable projects, and program of testing to demonstrate effectiveness for use on this project.
- C. Samples: Submit, for verification purposes, prior to mock-up erection, samples of the following:
 - 1. Each new exposed masonry material to be used for replacing existing materials. Include in each set of samples the full range of colors, colors, and textures to be expected in completed work.
 - a. For precast / stone provide samples not less than 12" x 12" in size.
 - 2. Each type of mortar for pointing and masonry rebuilding and repair, in form of 6" long by 1/2" wide sample strips of mortar set in aluminum or plastic channels.
 - 3. Each type of chemical cleaning material.
 - 4. Each type of adhesive.
 - 5. Each type of anchor.

1.5 DELIVERY, STORAGE AND HANDLING:

- A. Carefully pack, handle, and ship masonry units and accessories strapped together in suitable packs or pallets or in heavy cartons. Unload and handle to prevent chipping and breakage.
- B. Deliver other materials to site in manufacturer's original and unopened containers and packaging, bearing labels as to type and names of products and manufacturers.
- C. Protect masonry restoration materials during storage and construction from wetting by rain, snow, or ground water, and from staining or intermixture with earth or other types of materials.
- D. Protect grout, mortar, and other materials from deterioration by moisture and temperature. Store in a dry location or in waterproof containers. Keep containers tightly closed and away from open flames. Protect liquid components from freezing. Comply with manufacturer's recommendations for minimum and maximum temperature requirements for storage.

1.6 PROJECT CONDITIONS:

- A. Clean masonry surfaces only when air temperatures are 40 deg.F (4 deg.C) and above and will remain so until masonry has dried out, but for not less than 7 days after completion of cleaning.
- B. Do not repoint mortar joints or repair masonry unless air temperatures are between 40 deg.F

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

(4 deg.C) and 80 deg.F (27 deg.C) and will remain so for at least 48 hours after completion of work.

- C. Prevent grout or mortar used in repointing and repair work from staining face of surrounding masonry and other surfaces. Remove immediately grout and mortar in contact with exposed masonry and other surfaces.
- D. Protect sills, ledges and projections from mortar droppings.

1.7 SEQUENCING/SCHEDULING:

- A. Perform masonry cleaning work in the following sequence:
 - 1. Clean all masonry surfaces.
 - 2. Apply sealer to masonry

PART 2 - PRODUCTS

2.1 MASONRY MATERIALS:

- A. Unit Masonry.: Provide masonry and accessories, including units for lintels, arches, corners, and other special ground, cut, or sawed shapes where required to complete masonry restoration work.

2.2 CLEANING MATERIALS AND EQUIPMENT:

- A. Water for Cleaning: Clean, potable, free of oils, acids, alkalis, salts, and organic matter.
- B. Warm Water: Heat water to temperature of 140 deg.F-180 deg.F (60 deg.C-82 deg.C).
- C. Brushes: Fiber bristle only.
- D. Alkaline Prewash Cleaner: Manufacturer's standard alkaline cleaner for prewash applications only which are followed by acidic cleaner of type indicated for afterwash.
 - 1. Product: Subject to compliance with requirements, provide "Sure Klean 766 Prewash", ProSoCo, Inc.
- E. Acidic Cleaner: Manufacturer's standard strength acidic masonry restoration cleaner composed of hydrofluoric acid blended with other acids including trace of phosphoric acid and combined with special wetting systems and inhibitors.
 - 1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Sure Klean Restoration Cleaner" in grade Light Duty and Heavy Duty as needed for stone/precast. ProSoCo, Inc.
 - b. "Bio Clean" to all organic stained areas as needed by ProSoCo for brick, limestone, and granite.
- F. Chemical Paint Remover: Manufacturer's standard thixotropic/ alkaline formulation for removing paint coatings from masonry.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Diedrich 505/606/606X Paint Remover"; Diedrich Chemicals.
 - b. "Sure Klean Heavy-Duty Paint Stripper"; ProSoCo, Inc.
- G. Water-Rinsible Chemical Paint Remover: Manufacturer's standard thixotropic water-rinsible solvent formulation for removing paint coatings from masonry.
1. Product: Subject to compliance with requirements, provide "Sure Klean 509 Paint Stripper", ProSoCo, Inc.
- H. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film forming, strippable masking material for protecting glass, metal and polished stone surfaces from damaging effect of acidic and alkaline masonry cleaners.
1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Diedrich Acid Guard"; Diedrich Chemicals.
 - b. "Sure Klean Acid Stop"; ProSoCo, Inc.
- I. Spray Equipment: Provide equipment for controlled spray application of water and chemical cleaners, if any, at rates indicated for pressure, measured at spray tip, and for volume.
1. For spray application of chemical cleaners provide low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with cone-shaped spray-tip.
 2. For spray application of water provide fan-shaped spray-tip which disperses water at angle of not less than 15 degrees.
 3. For spray application of heated water provide equipment capable of maintaining temperature, at flow rates indicated, between 140 deg. and 180 deg.F (60 deg. and 82 deg.C).
 4. For application of steam provide a steam generator capable of delivering live steam at nozzle head.

PART 3 - EXECUTION

3.1 PREPARATION:

- A. General: Comply with recommendations of manufacturers of chemical cleaners for protecting building surfaces against damage from exposure to their products.
- B. Protect persons, motor vehicles, surrounding surfaces of building whose masonry surfaces are being restored, building site, and surrounding buildings from injury resulting from masonry restoration work.
 1. Prevent chemical cleaning solutions from coming into contact with pedestrians, motor vehicles, landscaping, buildings and other surfaces which could be injured by such contact.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Do not clean masonry during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
 3. Dispose of run-off from cleaning operations by legal means and in manner which prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
 4. Erect temporary protection covers over pedestrian walkways and at points of entrance and exit for persons and vehicles which must remain in operation during course of masonry restoration work.
- C. Protect glass, unpainted metal trim and polished stone from contact with acidic chemical cleaners by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape. Apply masking agent to comply with manufacturer's recommendations. Do not apply liquid masking agent to painted or porous surfaces.
1. Protection can be eliminated subject to Architect's approval if testing demonstrates no detrimental effect from exposure to cleaning solutions.
- D. Protect unpainted metal from contact with alkali chemical cleaners by covering them either with liquid strippable masking agent or polyethylene film and waterproof masking tape.

3.2 CLEANING MASONRY, GENERAL:

- A. Proceed with cleaning in an orderly manner; work from top to bottom of each scaffold width and from one end of each elevation to the other.
- B. Use only those cleaning methods indicated for each masonry material and location.
- C. Perform each cleaning method indicated in a manner which results in uniform coverage of all surfaces, including corners, moldings, interstices and which produces an even effect without streaking or damage to masonry surfaces.
- D. Rinse off chemical residue and soil by working upwards from bottom to top of each treated area at each stage or scaffold setting.
- E. Removal of Plant Growth: Remove plant, moss, and shrub growth completely from masonry surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing to dry as long as possible prior to removal. Remove loose soil or debris from open masonry joints to whatever depth it occurs.
 1. Apply ammonium sulfamate or other acceptable root killing material to plant roots, in accordance with manufacturer's instructions. Do not apply materials to plants or vegetation to remain.
- F. Water Application Methods:
 1. Spray Applications: Spray-apply water to masonry surfaces to comply with requirements indicated for location, purpose, water temperature, pressure, volume and equipment. Unless otherwise indicated, hold spray nozzle not less than 6" from surface of masonry and apply water from side to side in overlapping bands to produce uniform coverage and an even effect.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Low Pressure Spray: 100-400 psi; 3-6 gallons per minute.
 - b. Medium Pressure Spray: 400-800 psi; 3-6 gallons per minute.
 - c. High Pressure Spray: 800-1200 psi; 3-6 gallons per minute.
2. Steam Wash: Apply steam to masonry surfaces at pressures not exceeding 80 psi. Hold nozzle no less than 6" from surface of masonry and apply steam from side to side or in direction of tooling in overlapping bands to produce uniform coverage and an even effect.

G. Chemical Cleaner Application Methods:

1. General: Apply chemical cleaners to masonry surfaces to comply with chemical manufacturer's recommendations using brush or spray application methods, at Contractor's option, unless otherwise indicated. Do not allow chemicals to remain on surface for periods longer than that indicated or recommended by manufacturer.
2. Spray Application: Apply to pressures not exceeding 50 psi, unless otherwise indicated.
3. Reapplication of Chemical Cleaners: Do not apply chemical cleaners to same masonry surfaces more than twice. If additional cleaning is required use steam wash.

3.3 CLEANING MASONRY:

A. Cold Water Wash: At locations indicated, clean masonry surface with cold water applied as follows:

1. Low pressure spray.
2. Medium pressure spray.
3. High pressure spray.

B. Warm Water Wash: At locations indicated, clean masonry surfaces with warm water applied as follows:

1. Low pressure spray.
2. Medium pressure spray.
3. High pressure spray.

C. Chemical Cleaning: At locations indicated, clean masonry surfaces with acidic cleaner applied as follows:

1. Prewet masonry with cold water applied by low pressure spray.
2. Prewet masonry with warm water applied by low pressure spray.
3. Apply acidic cleaner to masonry. Let cleaner remain on surface for period indicated below before rinsing away:
 - a. As recommended by chemical cleaner manufacturer.
 - b. 2 to 3 minutes.
4. Rinse masonry with cold water to remove chemicals and soil, applied as follows:
5. Rinse masonry with warm water to remove chemicals and soil, applied as follows:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Low pressure spray.
 - b. Medium pressure spray.
 - c. High pressure spray.
6. Repeat chemical cleaning procedure above where required to produce effect established by mock-up. Do not apply more than twice.
- D. Paint Removal: At locations indicated, remove paint from masonry surfaces as follows:
1. Apply chemical paint remover to painted masonry with brushes.
 2. Allow chemical paint remover to remain on surface for period recommended by paint remover manufacturer.
 3. Remove chemical and paint residue by rinsing with water applied as follows:
 - a. Low pressure spray.
 - b. Medium pressure spray.
 - c. High pressure spray.
 4. Apply acidic cleaner as an after wash to masonry while it is still wet using low pressure spray equipment or soft fibered brush. Let cleaner remain on surface for period recommended by manufacturer, unless otherwise indicated.
 5. Rinse masonry with cold water to remove chemicals and soil, applied as follows:
 - a. Low pressure spray.
 - b. Medium pressure spray.
 - c. High pressure spray.
- E. Paint Removal with Water-Rinsible Chemical Paint Remover: At locations indicated, remove paint from masonry surfaces as follows:
1. Apply thick coating of water-rinsible chemical paint remover to painted masonry with natural fiber cleaning brush, deep-nap roller, or large paint brush.
 2. Allow chemical paint remover to remain on surface for period recommended by paint remover manufacturer. Agitate periodically with a stiff bristle brush.
 3. Remove chemical and paint residue by rinsing with water applied as follows:
 - a. Low pressure spray.
 - b. Medium pressure spray.
 - c. High pressure spray.

3.4 CLEANING STONework / PRECAST:

- A. Cold Water Wash: At locations indicated, clean stone surfaces by following procedure.
1. Prewet masonry with prolonged spraying for duration indicated below.
 - a. Continue spraying until surface encrustation has softened sufficiently to permit its removal by water wash.
 2. Remove soil and softened surface encrustation from stone by applying cold water as follows:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Low pressure spray.
 - b. Medium pressure spray.
 - c. High pressure spray.

 - B. Warm Water Wash: At locations indicated, clean stone surfaces with warm water applied as follows:
 - 1. Low pressure spray.
 - 2. Medium pressure spray.
 - 3. High pressure spray.

 - C. Cleaning with Acidic Cleaner: At locations indicated, clean stone surfaces with acidic cleaner of dilution indicated, applied as follows:
 - 1. Prewet masonry with cold water applied by low pressure spray.
 - 2. Prewet masonry with warm water applied by low pressure spray.
 - 3. Apply chemical cleaner to stone. Let cleaner remain on surface for period indicated below before rinsing away.
 - a. As recommended by chemical cleaner manufacturer.
 - b. 2 to 3 minutes.

 - 4. Rinse stone with cold water to remove chemicals and soil, applied as follows:
 - 5. Rinse stone with warm water to remove chemicals and soil, applied as follows:
 - a. Low pressure spray.
 - b. Medium pressure spray.
 - c. High pressure spray.

 - 6. Repeat entire cleaning procedure above where required to produce cleaning effect established by mock-up. Do not apply more than twice.
- 3.5 FINAL CLEANING:
- A. After mortar has fully hardened thoroughly clean exposed masonry surfaces of excess mortar and foreign matter using stiff nylon or bristle brushes and clean water, spray applied at low pressure.
 - B. Use of metal scrapers or brushes will not be permitted.
 - C. Use of acid or alkali cleaning agents will not be permitted.

END OF SECTION 04 01 20.52

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 4: MASONRY
Section 04 20 00: Unit Masonry

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Concrete unit masonry.
 - 2. 4" x 8"x16", 8" x 8" x 16" and 12" x 8" x 16" running bond pattern concrete unit masonry and masonry veneer.
 - 3. Structural pre-faced concrete masonry unit/tile.
- B. Related Sections: The following sections contain requirements that relate to this Section:
 - 1. Division 7 Section "Flashing and Sheet Metal" for exposed sheet metal flashing installed in masonry.
 - 2. Division 10 Section "Louvers and Vents" for wall vents.
- C. Products installed but not furnished under this Section include the following:
 - 1. Steel lintels in unit masonry are specified in Division 5 Section "Metal Fabrications."
 - 2. Wood nailers and blocking built into unit masonry are specified in Division 6 Section "Rough Carpentry."
 - 3. Reglets in masonry joints for metal flashing are specified in Division 7 Section "Flashing and Sheet Metal."
 - 4. Hollow metal frames in unit masonry openings are specified in Division 8 Section "Steel Doors and Frames."

1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops the following installed compressive strengths (f'm):
 - 1. For concrete unit masonry: As Indicated on Drawings

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract.
- B. Shop drawings for reinforcing detailing fabrication, bending, and placement of unit masonry reinforcing bars. Comply with ACI 315 "Details and Detailing of Concrete Reinforcing" showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of masonry reinforcement.
- C. Samples for initial selection purposes of the following:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Unit masonry sample in small-scale form showing units available for each different exposed masonry unit required.
 2. Colored masonry mortar samples showing full extent of colors available.
- D. Samples for verification purposes of the following:
1. Full-size units for each different exposed masonry unit required showing color, pattern and dimensions to be expected in completed construction.
 2. Colored masonry mortar samples for each color required showing the full range of colors expected in the finished construction.
 3. Aluminum weep holes/vents painted in color to match mortar color.
 4. Accessories embedded in the masonry.

1.5 QUALITY ASSURANCE

- A. Unit Masonry Standard: Comply with ACI 530.1/ASCE 6 "Specifications for Masonry Structures," except as otherwise indicated.
1. Revise ACI 530.1/ASCE 6 to exclude Sections 1.4 and 1.7; Parts 2.1.2, 3.1.2, and 4.1.2; and Articles 1.5.1.2, 1.5.1.3, 2.1.1.1, 2.1.1.2, and 2.3.3.9 and to modify Article 2.1.1.4 by deleting requirement for installing vent pipes and conduits built into masonry.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver masonry materials to project in undamaged condition.
- B. Store and handle masonry units off the ground, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not place until units are in an air-dried condition.
- C. Store cementitious materials off the ground, under cover, and in dry location.
- D. Store aggregates where grading and other required characteristics can be maintained, and contamination avoided.
- E. Store masonry accessories including metal items to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

- A. Protection of Masonry: During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Remove immediately any grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes from mortar droppings.

- D. Cold-Weather Construction: Comply with referenced unit masonry standard for cold-weather construction and the following:
 - 1. Do not lay masonry units that are wet or frozen.
 - 2. Remove masonry damaged by freezing conditions.

- E. Hot-Weather Construction: Comply with referenced unit masonry standard.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Comply with referenced unit masonry standard and other requirements specified in this Section applicable to each material indicated.

2.2 CONCRETE MASONRY UNITS

- A. General: Comply with requirements indicated below applicable to each form of concrete masonry unit required.
 - 1. Provide special shapes where indicated and as follows:
 - a. For lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
 - 2. Size: Provide concrete masonry units complying with requirements indicated below for size that are manufactured to specified face dimensions within tolerances specified in the applicable referenced ASTM specification for concrete masonry units.
 - a. Concrete Masonry Units: Manufactured to specified dimensions of 3/8 inch less than nominal widths by nominal heights by nominal lengths indicated on drawings.
 - 3. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.
 - a. Where special finishes are indicated, provide units with exposed faces of the following general description matching color and texture of Architect's sample.
 - 1) Split face finish as selected and equal to Block U.S.A. Grassell, Dry Block.
 - b. Split face block shall be equal to Block U.S.A. Grasselli, Lazy Gray.
 - 4. Block Colors: Colors as indicated on drawings at exterior veneer applications shall match existing.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Verify final color selection and patterns with Architect prior to ordering block.
- B. Hollow Load-Bearing Concrete Masonry Units: ASTM C 90, Grade N and as follows:
 - 1. Unit Compressive Strength: Provide units with minimum average net area compressive strength indicated below:
 - a. Not less than the unit compressive strengths required to produce concrete unit masonry construction of compressive strength indicated.
 - 2. Weight Classification: Normal weight.

2.2 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce required mortar color.
- B. Masonry Cement: ASTM C 91.
 - 1. For colored pigmented mortars use premixed colored masonry cements of formulation required to produce color indicated, or if not indicated, as selected from manufacturer's standard formulations. Use colored mortar with Dry-Block Additive supplied by concrete masonry unit supplier to match C.M.U.'s for monolithic appearance.
- C. Ready-Mixed Mortar: Cementitious materials, water, and aggregate complying with requirements specified in this article, combined with set-controlling admixtures to produce a ready-mixed mortar complying with ASTM C 1142.
- D. Hydrated Lime: ASTM C 207, Type S.
- E. Aggregate for Mortar: ASTM C 144, except for joints less than 1/4-inch use aggregate graded with 100 percent passing the No. 16 sieve.
 - 1. White Mortar Aggregates: Natural white sand or ground white stone.
- F. Aggregate for Grout: ASTM C 404.
- G. Colored Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with record of satisfactory performance in masonry mortars.
- H. Water: Clean and potable.
- I. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Colored Masonry Cement:
 - a. "Colorbond Custom Color Masonry Cement," Centurion.
 - b. "Atlas Custom Color Masonry Cement," Lehigh Portland Cement Co.
 - c. "Flamingo Color Masonry Cement," The Riverton Corporation.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2.3 REINFORCING STEEL

- A. General: Provide reinforcing steel complying with requirements of referenced unit masonry standard and this article.
- B. Steel Reinforcing Bars: Material and grade as follows:
 - 1. Billet steel complying with ASTM A 615.
 - 2. Grade 60.
- C. Deformed Reinforcing Wire: ASTM A 496.
- D. Plain Welded Wire Fabric: ASTM A 185.
- E. Deformed Welded Wire Fabric: ASTM A 497.

2.4 JOINT REINFORCEMENT

- A. General: Provide joint reinforcement complying with requirements of referenced unit masonry standard and this article, formed from the following:
 - 1. Galvanized carbon steel wire, coating class as required by referenced unit masonry standard for application indicated.
- B. Description: Welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10 feet, with prefabricated corner and tee units, and complying with requirements indicated below:
 - 1. Wire Diameter for Side Rods: 0.1483 inch (9 gage).
 - 2. Wire Diameter for Cross Rods: 0.1483 inch (9 gage).
 - 3. For single-wythe masonry provide type as follows with single pair of side rods:
 - a. Truss design with continuous diagonal cross rods spaced not more than 16 inches o.c.
 - 4. For multiwythe masonry provide type as follows:
 - a. Truss design with diagonal cross rods spaced not more than 16 inches o.c. and number of side rods as follows:
 - 1) Number of Side Rods for Multiwythe Concrete Masonry: One side rod for each face shell of hollow masonry units more than 4 inches in nominal width plus one side rod for each wythe of masonry 4 inches or less in nominal width.
 - b. Tab design with single pair of side rods and rectangular box-type cross ties spaced not more than 16 inches o.c.; with side rods spaced for embedment within each face shell of backup wythe and ties extended to engage the outer wythe by at least 1-1/2 inches.

2.5 TIES AND ANCHORS, GENERAL

- A. General: Provide ties and anchors specified in subsequent articles that comply with requirements for metal and size of referenced unit masonry standard and of this article.
- B. Galvanized Carbon Steel Wire: ASTM A 82, coating class as required by referenced unit masonry

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

standard for application indicated.

1. Wire Diameter: 0.1875 inch.
- C. Steel Plates and Bars: ASTM A 36, hot-dip galvanized to comply with ASTM A 123 or ASTM A 153, Class B3, as applicable to size and form indicated.

2.6 BENT WIRE TIES

- A. Individual units prefabricated from bent wire to comply with requirements indicated below:
- B. Tie Shape for Hollow Masonry Units Laid with Cells Vertical: Rectangular with closed ends and not less than 4 inches wide.
- C. Type for Masonry Where Coursing Between Wythes Align: Unit ties bent from one piece of wire.

2.7 ADJUSTABLE ANCHORS FOR CONNECTING MASONRY TO STRUCTURAL FRAMEWORK

- A. General: Two-piece assemblies as described below allowing vertical or horizontal differential movement between wall and framework parallel to plane of wall but resisting tension and compression forces perpendicular to it.
- B. For anchorage to concrete framework, provide manufacturer's standard with dovetail anchor section formed from sheet metal and triangular-shaped wire tie section sized to extend within 1 inch of masonry face and as follows:
- C. For anchorage to steel framework provide manufacturer's standard anchors with crimped 1/4-inch-diameter wire anchor section for welding to steel and triangular-shaped wire tie section sized to extend within 1 inch of masonry face and as follows:
1. Wire Diameter: 0.1875 inch.

2.8 MISCELLANEOUS ANCHORS

- A. Unit Type Masonry Inserts in Concrete: Cast iron or malleable iron inserts of type and size indicated.
- B. Dovetail Slots: Furnish dovetail slots, with filler strips, of slot size indicated, fabricated from 0.0336-inch (22-gage) sheet metal.
- C. Anchor Bolts: Steel bolts complying with A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations:
1. Headed bolts.

2.9 POSTINSTALLED ANCHORS

- A. Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing laboratory.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Type: Chemical anchors.
2. Corrosion Protection: Carbon steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).
3. For cast-in-place and postinstalled anchors in concrete: Capability to sustain, without failure, a load equal to 4 times loads imposed by masonry.
4. For postinstalled anchors in grouted concrete masonry units: Capability to sustain, without failure, a load equal to 6 times loads imposed by masonry.

2.10 EMBEDDED FLASHING MATERIALS

- A. Sheet Metal Flashing: Fabricate from the following metal complying with requirements specified in Division 7 Section "Flashing and Sheet Metal" and below:
 1. Fabricate through-wall metal flashings embedded in masonry as follows:
 - a. With ribs formed in dovetail pattern at 3-inch intervals along length of flashing to provide a three-way integral mortar bond and weep-hole drainage.
 2. Fabricate metal expansion joint strips from sheet metal indicated above, formed to shape indicated.
 3. Application: Use where flashing is partly concealed in masonry wall.
- B. Vinyl Sheet Flashing: Flexible sheet flashings especially formulated from virgin polyvinyl chloride with plasticizers and other modifiers to remain flexible and waterproof in concealed masonry applications, black in color and of thickness indicated below:
 1. Thickness: 20 mils.
 2. Application: Use where flashing is fully concealed in masonry.
- C. Solder and Sealants for Sheet Metal Flashings: As specified in Division 7 section "Flashing and Sheet Metal."

2.11 MISCELLANEOUS MASONRY ACCESSORIES

- A. Nonmetallic Expansion Joint Strips: Premolded filler strips complying with ASTM D 1056, Type 2 (closed cell), Class A (cellular rubber and rubber-like materials with specific resistance to petroleum base oils), Grade 1 (compression-deflection range of 2-5 psi), compressible up to 35 percent, of width and thickness indicated, formulated from the following material:
 1. Neoprene.
- B. Preformed Control Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
 1. Styrene-Butadiene Rubber Compound: ASTM D 2000, Designation 2AA-805.
- C. Bond Breaker Strips: Asphalt-saturated organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Weep Holes: Provide the following:
 1. Rectangular Plastic Tubing: Clear butyrate, 3/8 inch by 1-1/2 inches by 3-1/2 inches long.
 2. Plastic Weep Hole/Vent: One-piece flexible extrusion manufactured from ultraviolet-resistant polypropylene co-polymer, designed to weep moisture in masonry

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

cavity to exterior, sized to fill head joints with outside face held back 1/8 inch from exterior face of masonry, in color selected from manufacturer's standard.

2.13 MASONRY CLEANERS

- A. Job-Mixed Muriatic Solution: Solution of 1-part muriatic acid and 10 parts clean water, mixed in a nonmetallic container with acid added to water.

2.14 MORTAR AND GROUT MIXES

- A. General: Do not add admixtures including coloring pigments, air-entraining agents, accelerators, retarders, water repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
1. Do not use calcium chloride in mortar or grout.
- B. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification for job-mixed mortar and ASTM C 1142 for ready-mixed mortar, of types indicated below:
1. Limit cementitious materials in mortar to portland cement-lime.
 2. For masonry below grade and in contact with earth, and where indicated, use type indicated below:
 - a. Type S.
 3. For reinforced masonry and where indicated, use type indicated below:
 - a. Type S.
 4. For exterior, above-grade loadbearing and nonloadbearing walls and parapet walls; for interior loadbearing walls; for interior nonloadbearing partitions, and for other applications where another type is not indicated, use type indicated below:
 - a. Type N.
- C. Colored Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required.
- D. Grout for Unit Masonry: Comply with ASTM C 476 and referenced unit masonry standard.

2.15 STRUCTURAL PRE-FACED CONCRETE MASONRY UNITS

- A. Manufacturers / Products:
1. Spectra-Glaze
 2. Trenwyth – Astra – Glaze
 3. Equal products of pre-faced glazed c.m.u. / tile.
- B. Facing Components: Facing ingredients must be equal to Spectra-Glaze Compound made with Spectra-Glaze polymers or equal, supplied to approved manufacturers by The Burns & Russell Company or equal, and other ingredients as required to meet or exceed Burns & Russell product standards and ASTM C 744.
- C. Pre-Faced Surfaces: Interior use – smooth, colored satin finish conforming to Burns & Russell products standards or equal and ASTM C 744. Exterior use – smooth, satin finish, conforming to ASTM C 744, ASTM C 67, paragraph 8 (freeze-thaw) and Thermal Shock Test B100JL, 24P.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- D. Colors: Select from Manufacturer's established or custom colors. All Standard, Vari-tone, or Special Colors. Series must conform to ASTM C 744.
- E. Surface Burning Characteristics of Facing: ASTM E 84; flame spread less than 25; fuel contribution 0; smoke density less than 50. Products of combustion considered non-toxic as determined by BRC 4690 (toxicity testing).
- F. Types: Plain, 8" x 8" x 16" Running bond.
- G. Glazed Face Sizes and Joints: Modular 8" x 16", 4" x 16", 8" x 8", 12" x 12", 16" x 16" including 1/4" exposed face joints; sizes as shown; long dimensions, horizontal or vertical as shown.
- H. Concrete Block for Glazing: ASTM C 90 for hollow and solid load-bearing units; Type 1 (moisture controlled). For exterior use require Block-Rite integral efflorescence control system.
- I. Hourly Fire Ratings for Concrete Block: Fireproof or fire rated as required by partition rating shown on Reflected Ceiling/Life Safety Plans.
- J. Concrete Block Sizes Before Glazing: Modular 2" x 4", 6", 8", 10", 12" thickness as needed, and as shown on drawings.
- K. Through-The-Wall Units: Use pre-faced block thickness equal to nominal wall thickness where possible.
- L. Shapes: Provide shapes to suit the condition shown.
- M. Jointing Tools: Use glass 5/8" for concave joints; clean, non-staining metal tools elsewhere. Replace worn tools promptly.
- N. Mortars: Waterproof epoxy grout in gray color.
- O. Related Products: Provide setting mortar, horizontal wire reinforcing, ties and anchors and other accessories needed to properly complete the work.
- P. Cleaning Compound: Use masonry detergent cleaners such as Spectra brand of cleaners or equal, Vana-Trol or Deox in strict accordance with each manufacturer's directions. **Do not use any product containing unbuffered hydrochloric acid or other unbuffered acids.**

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other specific conditions, and other conditions affecting performance of unit masonry.
- B. Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.
- C. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Comply with referenced unit masonry standard and other requirements indicated applicable to each type of installation included in Project.
- B. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual thickness of the masonry units, using units of nominal thickness indicated.
- C. Build chases and recesses as shown or required to accommodate items specified in this and other Sections of the Specifications. Provide not less than 8 inches of masonry between chase or recess and jamb of openings and between adjacent chases and recesses.
- D. Leave openings for equipment to be installed before completion of masonry. After installation of equipment, complete masonry to match construction immediately adjacent to the opening.
- E. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units without cutting where possible.

3.3 CONSTRUCTION TOLERANCES

- A. Comply with construction tolerances of referenced unit masonry standard.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement-type joints, returns, and offsets. Avoid the use of less-than-half-size units at corners, jambs, and where possible at other locations.
- B. Lay up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.
- C. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
 - 1. One-half running bond with vertical joint in each course centered on units in courses above and below align pattern veneer joints with units above and below at alternate courses.
- D. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- E. Stopping and Resuming Work: In each course, rack back 1/2-unit length for one-half running bond or 1/3-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly (if required), and remove loose masonry units and mortar prior to laying fresh masonry.
- F. Built-In Work: As construction progresses, build-in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.
 - 1. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.
 - 2. Fill cores in hollow concrete masonry units with grout 3 courses (24 inches) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow concrete masonry units as follows:
 - 1. With full mortar coverage on horizontal and vertical face shells.
 - 2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
 - 3. For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells.
- B. Cut joints flush for masonry walls to be concealed or to be covered by other materials, unless otherwise indicated.

3.6 CAVITIES/AIR SPACES

- A. Keep cavities/air spaces clean of mortar droppings and other materials during construction. Strike joints facing cavities/air spaces flush.
- B. Install vents in vertical head joints at the top of each continuous cavity/air space. Space vents and close off cavities/air spaces vertically and horizontally with blocking in manner indicated.

3.7 HORIZONTAL JOINT REINFORCEMENT

- A. General: Provide continuous horizontal joint reinforcement as indicated. Install longitudinal side rods in mortar for their entire length with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcing a minimum of 6 inches.
- B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 ANCHORING MASONRY TO STRUCTURAL MEMBERS

- A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
 - 1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.
 - 2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.
 - 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.9 ANCHORING SINGLE-WYTHE MASONRY VENEER

- A. Anchor single-wythe masonry veneer to metal studs with masonry veneer anchors to comply with the following requirements:
 - 1. Fasten each anchor section through sheathing to metal studs with 2 metal fasteners of type indicated.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Locate anchor section relative to course in which tie section is embedded to allow maximum vertical differential movement of tie up and down.
 3. Space anchors as indicated but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally with not less than one anchor for each 2 sq. ft. of wall area. Install additional anchors within 1'-0" of openings and at intervals around perimeter not exceeding 8 inches.
- B. Install vents at the top of each continuous air space in masonry veneer walls.

3.10 MOVEMENT (CONTROL AND EXPANSION) JOINTS

- A. General: Install control and expansion joints in unit masonry where indicated, but not less than 30' – 0" o.c. typical. Build in related items as the masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.
- B. Form control joints in concrete masonry as follows:
1. Install preformed control joint gaskets designed to fit standard sash block.

3.11 LINTELS

- A. Provide masonry lintels where shown and wherever openings of more than 1'-0" for brick size units and 2'-0" for block size units are shown without structural steel or other supporting lintels. Provide precast or formed-in-place masonry lintels. Cure precast lintels before handling and installation. Temporarily support formed-in-place lintels.
1. For hollow concrete masonry unit walls, use specially formed bond beam units with reinforcement bars placed as indicated and filled with coarse grout.
- B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.12 FLASHING/WEEP HOLES

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to the downward flow of water in the wall, and where indicated.
- B. Prepare masonry surfaces so that they are smooth and free from projections that could puncture flashing. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing with adhesive/sealant/tape as recommended by flashing manufacturer before covering with mortar.
- C. Install flashings as follows:
1. At lintels and shelf angles, extend flashing a minimum of 4 inches into masonry at each end. Extend flashing from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 4 inches, and through the inner wythe to within 1/2 inches of the interior face of the wall in exposed masonry. Where interior surface of inner wythe is concealed by furring, carry flashing completely through the inner wythe and turn up approximately 2 inches, unless otherwise indicated.
 2. At heads and sills, extend flashing as specified above unless otherwise indicated but turn up ends not less than 2 inches to form a pan.
 3. Interlock end joints of ribbed sheet metal flashings by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer and seal lap with elastomeric sealant

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- complying with requirements of Division 7 Section "Joint Sealers" for application indicated.
4. Turn down sheet metal flashings at exterior face of masonry to form drip.
 5. Cut off flashing flush with face of wall after masonry wall construction is completed.
- D. Install weep holes in the head joints in exterior wythes of the first course of masonry immediately above embedded flashings and as follows:
1. Form weep holes with product specified in Part 2 of this Section.
 2. Space weep holes 24 inches o.c.

3.13 INSTALLATION OF REINFORCED UNIT MASONRY

- A. General: Install reinforced unit masonry to comply with requirements of referenced unit masonry standard.
- B. Temporary Formwork: Construct formwork and shores to support reinforced masonry elements during construction.
1. Construct formwork to conform to shape, line, and dimensions shown. Make sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
- C. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.
- D. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

3.14 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units and in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints including corners, openings, and adjacent construction to provide a neat, uniform appearance, prepared for application of sealants.
- C. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 2. Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
 4. Wet wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
 5. Clean brick by means of bucket and brush hand-cleaning method described in BIA "Technical Note No. 20 Revised" using the following masonry cleaner:
 - a. Job-mixed acidic solution.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

6. Clean concrete masonry by means of cleaning method indicated in NCMA TEK 45 applicable to type of stain present on exposed surfaces.
- D. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure unit masonry is without damage and deterioration at time of Substantial Completion.

3.15 EXECUTION FOR PRE-FACED CONCRETE BLOCK UNITS

- A. Execution: Inspect related conditions; do not start at any location until all adverse conditions at that location have been corrected.
- B. Lighting: Do not work without proper lighting.
- C. Floor Surface: Test for straightness, levelness. Notify job superintendent where grinding or troweled filler corrections are needed.
- D. Aligning Base Course: Do not set base course to follow an inaccurate floor line.
- E. Cove Base at Thin Floor Covering: Set cove base tight to a straight, level floor so edge of floor covering will hide the joint.
- F. Workmanship: Align glazed faces plumb, level and true to line; uniform joint widths carefully tooled; joints arranged neat and symmetrical, cut units sized and located for best appearance; free of imperfections detracting from overall appearance when viewed at 90 degrees from 5 feet.
- G. Cutting: For all cuts, including chases, holes and notches for pipes, switch boxes, etc., use saw and other power tools.
- H. Jointing: Except where tuckpointing is noted, strike and tool setting mortar.
- I. Tuckpointing: Rake out joints at least $\frac{1}{4}$ ". Tuckpoint with the required mortar type. Do not use smeared grout method to fill joints.
- J. Horizontal Reinforcing: Use in accordance with best practices for concrete block work and applicable building codes.
- K. Vertical Control Joints: Use in accordance with best practice for concrete block work.
- L. Exterior Weep Vent Installation: Where applicable, use weep vents at least 4" long in vertical joint for every second block in base course immediately above grade and immediately above flashing, bond beams, solid fill or other water-stop locations.
- M. Keeping Glaze Clean: Wipe off all mortar smears and spatters at once, using clean, soft, damp rags. Do not allow hardening.
- N. Final Cleandown: Use industrial strength detergents in strict accordance with cleaner manufacturer's instruction, including thorough rinsing. Damp-dry with clean, soft rags. Do not use steel wool, other abrasives or any products containing unbuffered hydrochloric acid.

END OF SECTION 04 20 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 4: MASONRY
Section 04 21 00: Architectural Face Brick

PART 1 GENERAL

Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section.

1.1 SECTION INCLUDES

- A. Brick units.
- B. Reinforcement, anchors, and accessories.

1.2 RELATED SECTIONS

- A. Section 03300 - Cast in Place Concrete
- B. Section 05500 - Miscellaneous Metals: Loose steel lintels, foundation vents.
- C. Section 06100 - Rough Carpentry.
- D. Section 07600 - Flashing and Sheet Metal
- E. Section 07901 – Joint Sealant.

1.3 REFERENCES

- A. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- B. ASTM C 216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale).
- C. ASTM D 1056 - Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Selection Samples: For each product specified, two complete samples of brick to reflect the full range of color, shades and surface texture of brick specified.
- C. Verification Samples: For each product specified, two samples of four brick each, representing actual product, color, and texture.
- D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.5 MOCKUP

- A. As soon as the brick and stone samples have been approved, deliver enough brick to the job site to construct a 4 foot by 4-foot mockup wall panel.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. Construct the mockup panel using the brick, mortar, reinforcing, weep holes, tooling, and cleaning as specified, with appropriate backup walls as shown on the Drawing.
- C. The approved sample panel shall be a standard of workmanship for the Work.
- D. As construction proceeds, the first full panel of brickwork, between expansion joints shall become the standard of workmanship for issues, such as head joint alignment, that are not apparent on the smaller mockup panel.
- E. Mockup panel shall not be removed until masonry work required by this Section has been completed and accepted.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials to prevent inclusion of foreign materials and damage by water or weather. Store packaged materials in their original packages. Remove damaged or deteriorated materials from the premises

1.7 PROJECT CONDITIONS

- A. Follow hot weather and cold weather requirements in the masonry code and specifications, TMS 402 and TMS 602.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Acme Brick Company, Boral Brick Company, Taylor Clay Products, Carolina Ceramics, or approved equivalent.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 BRICK UNITS

- A. Face Brick: Brick shall be Type FBS or HBS as follows:
 - 1. Match Existing. Mock up is required to verify new brick and mortar to match existing and is required to be approved by Architect prior to procurement.
- B. Special shape face bricks shall be as detailed and at locations as indicated on the Drawings.
- C. Furnish special uncured face brick in locations where cores would be exposed in finish work.

Color and Pattern:
 - 1. Match Existing. Mock up is required to verify new brick and mortar to match existing and is required to be approved by Architect prior to procurement.

2.3 MORTAR AND GROUT MIXES

- A. General: Do not add admixtures including coloring pigments, air-entraining agents, accelerators, retarders, water repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Do not use calcium chloride in mortar or grout.
- B. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification for job-mixed mortar and ASTM C 1142 for ready-mixed mortar, of types indicated below:
1. Limit cementitious materials in mortar to portland cement-lime.
 2. For masonry below grade and in contact with earth, and where indicated, use type indicated below:
 - a. Type S.
 3. For reinforced masonry and where indicated, use type indicated below:
 - a. Type S.
 4. For exterior, above-grade loadbearing and nonloadbearing walls and parapet walls; for interior loadbearing walls; for interior nonloadbearing partitions, and for other applications where another type is not indicated, use type indicated below:
 - a. Type N.
- C. Grout for Unit Masonry: Comply with ASTM C 476 and referenced unit masonry standard.

2.3 ANCHORS AND TIES

- A. Acceptable Manufacturers:
1. Products of Hohmann and Barnard and Heckman Building Products, conforming to specification requirements are acceptable.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01600.
- C. Anchors:
1. Slotted anchors of type DW10 shall be used with steel stud or wood stud backup walls unless noted otherwise.
 2. Dur-O-Eye or equal anchors welded to joint reinforcing shall be used with masonry backup walls. Missing or damaged anchors shall be replaced as necessary with DW10 anchors fastened to wall with corrosion resistant Tapcon screws.
 3. Zinc coating shall comply with ASTM A153-B2.

2.4 ACCESSORIES

- A. Weep Holes: Preformed weeps for full head joint.
- B. Compressible Filler: Premolded, flexible cellular neoprene rubber filler strips complying with ASTM D 1056, Grade RE41E1, capable of compression up to 35 percent of width and thickness indicated.
- C. Mortar Net: Provide continuous Mortar Net along base of air space to catch mortar drippings. High-density polyethylene, 90 percent open mesh, dovetail shape.
- D. As an alternate to Mortar Net, every third brick may be left out at base of air space and cavity cleaned and inspected to be free of mortar droppings.

PART 3 EXECUTION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3.1 EXAMINATION

- A. Do not begin installation until backup substrates have been properly prepared.
- B. Verify field conditions are acceptable and are ready to receive work.
- C. Verify built-in items are in proper location, and ready for roughing into masonry work.
- D. If backup substrate and other preparation work is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Furnish temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent support.

3.3 INSTALLATION

- A. Pre-wet all brick having initial rate of absorption greater than 30 before laying.
- B. Heat water and sand in cold weather. Do not lay brick in temperature below freezing unless such heating of materials and protection of work is properly provided for.
- C. Lay brickwork true to dimensions, plumb, square, and in bond. All courses shall be level with joints of uniform width and height.
- D. Vertical joints in facing bond work shall be spaced so as to line up plumb and true, and all joints shall be as uniform as the type of brick will allow.
- E. Lay facing brick in full mortar bed with shoved head joints. Completely fill joints with mortar. Do not deep furrow bed joints.
- F. Allow space for caulking of joints at frames.
- G. Bond for facing brick shall be running bond unless otherwise indicated on the Drawings. Match existing bond patterns unless noted otherwise.
- H. Anchor facing brick to metal studs or masonry backup at 16 inches o.c. vertically and 16 inches o.c. horizontally with adjustable anchors and ties.
- I. Joint thickness shall be such as to provide coursing pattern to match existing brickwork. When the joints have become thumbprint hard, all exposed joints shall be tooled with a sled-jointing tool. The jointer shall be larger than the width of the joints so that a complete contact is made along the edges of the units, compressing, and sealing the surface of the joint. Joints shall be pointed as the tool proceeds.
- J. Form weep holes in head joints at face brick over shelf angles and lintels and where shown on the Drawings. Rake out bed joint mortar to clean flashing surface. Weep holes shall be filled with preformed mesh type vent at bottom of head joints not more than 24 inches o.c.
- K. Keep air space clean of mortar at all times. Where brick extends below grade, fill brick cavity solid to level of flashing and slope mortar slightly to outside under flashing.
- L. When flashing is to be laid on or against masonry, the surface of the masonry shall be smooth and free from projections that might puncture the flashing material.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- M. Where fresh masonry joins masonry that is partially set or totally set, the exposed surface of the set masonry shall be cleaned and lightly wetted so as to obtain the best possible bond with the new work. All loose brick and mortar shall be removed.
- N. Expansion Joints:
 - 1. Vertical: Locate where indicated on Drawings. Lay units to form a vertical joint free of mortar and of same width as normal head joint.
 - 2. Horizontal: Locate under shelf angles and other dissimilar materials abutted by brick. Maintain a clear space at least 1/4-inch thick free of mortar. Inspect with trowel before installing backer rod and sealant.
 - 3. Sealant. Shall be in accordance with Section 07900.

3.4 FLASHING

- A. Build in, as the work progresses all flashings which enter the masonry as specified in Sections 07600 Sheet Metal Flashing.
- B. Extend all flexible flashing 1-inch past face of wall and trim after tooling joints.
- C. Where metal flashing or drip edge is shown, align drip with face of brick. Edge of flashing or drip edge shall be a simple hem rolled edge and not turned down.

3.5 OPENINGS AND HOLES

- A. Provide all chases and recesses in masonry work of all types as indicated on the Drawings and as required for pipes, ducts, and other work of Mechanical and Electrical trades. Such work shall be accurately located by the trades requiring the work, but masonry work shall not be constructed without giving other trades due notices and opportunity to lay out or install such items as may be required for their work.
- B. Where required for installation of work of other trades, leave openings as indicated on the Drawing or as required to receive a later installation.
- C. After work of other trades is in place, openings shall be neatly filled with masonry of the same type as in the adjoining surfaces.

3.6 SETTING AND BUILDING-IN

- A. Build-in materials occurring in any type of masonry construction that are furnished by other trades. All built-in work shall be accurately placed, secured, held in position, and located by the trade requiring the work.
- B. Set and built -in items of related miscellaneous iron such as loose lintels and anchors required to complete all parts not connected to building framing.
- C. Set all anchor bolts required for the attachment of work to masonry.
- D. Build-in recesses, flashings, receivers, slots, anchors, sleeves, and other work shown on Drawings.

3.7 CLEANING

- A. After tooling and pointing is done, clean face brick surface with dry brush.
- B. After 3 days clean with water and mild detergent or cleaners recommended by brick manufacturer. Do not use muriatic acid.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Wet brick surfaces thoroughly before applying cleaning solution.
2. Apply cleaning solution with bucket and brush or LOW-PRESSURE spray.
3. Remove all stains and mortar streaks using stiff fiber bristle brush.
4. Rinse THOROUGHLY with water.
5. Protect windows, landscaping, and surrounding masonry surfaces from cleaning solution and rinse water.

END OF SECTION 04 21 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 5 METALS
Section 05 05 13 Shop-Applied Coatings for Metal

PART 1 - GENERAL Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this Section.

1.1 SUMMARY

- A. This Section includes shop-applying a special coating product to items and surfaces scheduled, including surface preparation & cleanliness, environmental conditions during application, product preparation, and application method.
- B. Type of factory-applied metal coating use as indicated on the drawings and schedules is as follows:
 - 1. Micaceous Iron Oxide and Zinc-Filled Polyurethane: One-component moisture-curing, polyurethane primer.
- C. Related Work:
 - 1. Documents affecting work of this Section include, but are not limited to, General Conditions, Supplementary Conditions, Sections in Division 1 of these Specifications, and including the following Divisions:
 - a. Division 5 – Structural & Miscellaneous Steel
 - 1) Section 05120 and Section 05500
 - b. Division 7 – Thermal & Moisture Protection
 - 2) Section 07810 Applied Fireproofing
 - c. Division 9 – Finishes
 - 3) Section 09900 and Section 09960

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM B 117 Standard Test Method for Corrosion Resistance.
 - 2. ASTM D 2794 Standard Test Method for Measuring Direct Impact.
 - 3. ASTM D 3359 Standard Test Methods for Measuring Adhesion by Tape Test.
 - 4. ASTM D 3363 Standard Test Method for Film Hardness by Pencil Test.
 - 5. ASTM D 4060 Standard Test Method for Abrasion Resistance.
 - 6. ASTM D 4541 Standard Test Method for Pull-off Strength of Coatings Using Portable Adhesion Testers.
 - 7. ASTM E 119 (UL 263) Standard Test Method for Fire Tests of Building and Construction Materials.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

8. ASTM E 736 Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.

B. Society of Protective Coatings (SSPC):

1. SSPC Surface Preparation Specifications (SSPC-SP)
2. SSPC Paint Application Specifications and Guides (SSPC-PA)

C. American Institute of Steel Construction

1. Slip Coefficient and Tension Creep

D. NACE International

1.3 DEFINITIONS

A. Definitions as used in Finish Schedule shown on Drawings and Coating Schedule included herein.

1. Coatings: Paint or heavy duty finishes for use on surfaces subject to interior and exterior exposure, submergence, high moisture, splash, or chemical environment, including primers, sealers, fillers, and intermediate and finish coats.
2. Normal: Surfaces subject to normal temperature and humidity.
3. First Coat: Factory primer or shop primer.
4. DFT: Dry Film Thickness (Mils/coat).
5. SqFt: Square feet per gallon (per coat).

1.4 SUBMITTALS

A. Product Data:

1. Manufacturer's literature including application recommendations and generic makeup for each coating scheduled.
2. List each material and cross-reference the specific coating, finish system, and application.

B. Submit one copy of manufacturer's Material Safety Data Sheets (MSDS) for each type of coating to ARCHITECT'S field office for information. CONTRACTOR shall post a copy of MSDS on the site at all times when coating is in progress.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. All coatings shall conform to OSHA requirements for allowable exposure to lead and other hazardous substances.

B. Product Manufacturer:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Manufacturer shall be a company that specializes in producing high quality industrial coating materials. This company shall have 10 years or more experience demonstrated by case histories in the designated field of application.

C. Applicator Qualifications:

1. Engage an experienced applicator with 5 years or more experience who has successfully completed coating system applications similar in material and extent to those indicated.

D. Single-Source Responsibility:

1. Provide coating material produced by the same manufacturer for each system.

E. Performance Testing:

1. The OWNER/ARCHITECT may request testing from the manufacturer for required performance that may include but is not limited to adhesion to the substrate and between coating layers, and resistance to abrasion, humidity, freeze/thaw, and Ultra-violet light exposure.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be delivered to the site in original containers with labels intact and seals unbroken.
- B. Protect and heat or cool material storage location to maintain temperature ranges recommended by coating manufacturers, but not less than 50 degrees F.
- C. Oily rags and waste must be removed from buildings each night or kept in appropriate metal containers. Provide fire extinguishers of the type recommended by coating manufacturers in areas of storage and where finishing is occurring. Allow no smoking or open containers of solvent.
- D. Empty containers shall have labels canceled and clearly marked as to use.

1.7 PROJECT / SITE CONDITIONS

A. Environmental Requirements:

1. Use indirect-fired dry heat and ventilate areas to obtain conditions recommended by coating manufacturer.
2. Relative humidity conditions as specified by coating manufacturer shall be adhered to.
3. No unprotected, unheated exterior coating shall be undertaken when cold, damp, foggy, or rainy weather appears probable, nor when the temperature of the substrate is below 35 degrees F, unless listed in this specification or approved in writing by the coating manufacturer.
4. Maintain the manufacturer's environmental requirements until the coating is fully cured.
5. Apply no coating in areas where dust is being generated.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

6. Testing and disposal of any waste and coating shall be the responsibility of the CONTRACTOR.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Tnemec Company, Inc., 6800 Corporate Drive, Kansas City, MO 64120

2.2 SHOP APPLIED PRIMERS FOR METAL

- A. Factory-applied coating products of Tnemec Company, Inc. are listed as the standard of quality and performance, and it is not the intent of the Specifier that these materials are to be used to the exclusion of equivalent products of other manufacturers.
- B. Only coatings that meet or exceed the performance of these specified coatings may be submitted for use. No substitutions will be considered that change the generic chemistry of the coatings specified.
- C. No substitution will be considered unless the Architect/Owner has received a written request for approval at least 10 days prior to the bid date for receipt of bids. Each request shall include the name of the specified material for which a substitute is being requested; name of the proposed substitute material; and a complete description of the proposed substitute including performance & test data, cure times, recoat windows, and generic composition. No request for substitution will be considered that would decrease film thickness or offer a change in the generic type of coating specified. The decision of the Architect/Owner regarding approval or disapproval of the proposed substitution shall be final.

2.3 MIXING AND THINNING

- A. Where thinning is necessary, only the products of the manufacturer furnishing the coating will be allowed. All such thinning shall be done in strict accordance with the coating manufacturer's recommendations
- B. Mix in accordance to the manufacturer's recommendations

2.4 SOURCE QUALITY

- A. Source Quality: Obtain painting, coating, and thinning materials from a single manufacturer.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's product data, including technical information, catalogue instructions, and product instructions listed on material containers.

3.2 EXAMINATION

- A. Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to the timely and proper completion of the work. Materials removed and replaced to correct defects due to errant application such as overspray or drips on unsuitable surfaces shall be at the CONTRACTOR'S expense.

3.3 SURFACE PREPARATION

A. General:

1. All surfaces to be coated shall be prepared as specified herein and in accordance with the coating manufacturer's recommendations. The object shall be to obtain a uniform, clean, and dry surface.
2. Quality of surface preparation described herein is considered a minimum. If the coating manufacturer requires a higher degree of preparation, comply with the coating manufacturer's recommendations.
3. Workmanship for surface preparation shall conform to the following Society of Protective Coatings (SSPC) / NACE specification:

d. Solvent Cleaning:	SSPC-SP1
e. Hand Tool Cleaning:	SSPC-SP2
f. Power Tool Cleaning:	SSPC-SP3
g. White Metal Blast Cleaning:	SSPC-SP5 / NACE No. 1
h. Commercial Blast Cleaning:	SSPC-SP6 / NACE No. 3
i. Brush-Off Blast Cleaning:	SSPC-SP7 / NACE No. 4
j. Near-White Blast Cleaning:	SSPC-SP10 / NACE No. 2
k. Power Tool to Bare Metal Cleaning:	SSPC-SP11
l. High Pressure Water Jetting:	SSPC-SP12 / NACE No. 5

3.4 FERROUS METAL

- A. Ferrous Metal unprimed or shop-primed with an incompatible primer shall be abrasive blast cleaned prior to the application of a primer. Enclosed structural metals or those scheduled for overcoating with fire-resistive materials shall be prepared in accordance with SSPC-SP3. Exposed exterior elements shall be prepared in accordance with SSPC-SP6. Slip critical connections shall be prepared in accordance with SSPC-SP3 or SP5.

3.5 APPLICATION

- A. Surfaces shall be dry at the time of application.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. The minimum surface temperature shall be 35 degrees F and rising unless noted otherwise.
- C. Apply in strict accordance to the manufacturer's recommendations by airless spray application.
- D. Each coat shall be allowed to dry in accordance to the manufacturer's requirements. Drying time shall be construed to mean "under normal conditions." Where conditions other than normal exist, because of weather or because of confined space, longer times will be necessary.
- E. Coatings shall be applied to provide an opaque smooth surface of uniform coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, or other surface imperfections will not be acceptable.
- F. Edges of coatings adjoining other materials or other colors shall be sharp and clean without overlapping.
- G. Crevices and other hard to apply areas shall be brushed in prior to the complete application.

3.6 FINAL TOUCH-UP AND CLEANING

- A. Prior to substantial completion, examine the coated surfaces and retouch or refinish surfaces to leave in condition acceptable to the ARCHITECT/OWNER

3.7 SHOP APPLIED COATING SCHEDULE

A. Perimeter Structural Steel

- 1. Common Use: For use on unprimed structural and miscellaneous steel.
- 2. Shop primer may be enclosed, covered with approved/tested spray-applied fireproofing, or finish painted.
- 3. Surface Preparation:
 - a. SSPC-SP3 – Enclosed areas or members to be fireproofed
 - b. SSPC-SP6 – Exterior exposures
- 4. Moisture-Cured Urethane Primer
 - a. Shop Primer: Tnemec Series 394 PerimePrime @ 2.5 – 3.5 mils DFT.
 - b. Performance Requirements:
 - 4) ASTM B 117: Primer Shall Pass 10,000 Hours Salt Fog Corrosion Resistance.
 - 5) ASTM E 736: Primer Shall Pass Bond Test Requirements.
 - 6) ASTM D 3359: Primer and complete coating system shall have a Rating not less than 5.
 - 7) ASTM 2794: No Visible Cracking or Delamination of Film after 160 Inch-Pounds Or Less Direct And Indirect Impact.
 - 8) ASTM D 4585: No Blistering, Cracking, Rusting or Delamination of Film after 5,000 Hours Exposure.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- 9) UL 263 (ASTM E 119): Primer Shall Be UL Classified for use Under Selected Fire-Resistive Materials.
- 10) AISC Static Fatigue: Primer Shall Meet Requirements Of A Class B Surface With A Mean Slip Coefficient No Less Than 0.56 And A Tension Creep Not In Excess Of .005 Inch Over SSPC-SP3 Or SP5 Prepared Substrate.

END OF SECTION 05 05 13

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 5: METALS
Section 05 12 00: Structural Steel

PART 1 - GENERAL

1.01 RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK:

- A. Extent of structural steel work is shown on drawings, including schedules, notes and details to show size and location of members, typical connections, and type of steel required.
- B. Structural steel is that work defined in AISC "Code of Standard Practice" and as otherwise shown on drawings.
- C. Miscellaneous Metal Fabrications are specified elsewhere in Division 5.

1.03 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of following, except as otherwise indicated:
 - 1. AISC "Code of Standard Practice for Steel Buildings and Bridges"
 - 2. Paragraph 4.2.1 of the above code is hereby modified by deletion of the following sentence: "This approval constitutes the Design Builder's acceptance of all responsibility for the decision adequacy of any connections designed by the fabricator as a part of his preparation of these shop drawings."
 - 3. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings," including "Commentary" and Supplements thereto as issued.
 - 4. AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.
 - 5. AWS D1.1 "Structural Welding Code"
 - 6. ASTM A6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use"
- B. Qualifications for Welding Work: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure." Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests. Certification must be current (less than 1 year old). If recertification of welders is required, retesting will be Contractor's responsibility. Contractor must furnish a copy of each welders current certification prior to welder performing work on the project.
- C. Installer Qualifications: Engage an experienced installer who has completed structural steel work similar in material, design, and extent to that indicated for this project and with a record of successful in-service performance.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- D. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the work.
1. Fabricator must participate in the AISC Quality Certification Program and be designated an AISC-Certified Plant as follows:
 - a. Category: Category I, conventional steel structures.
 - b. Fabricator shall be registered with and approved by authorities having jurisdiction.
- E. Firms wishing to bid the work, but not participating in the AISC Certification, may seek pre-qualification by making submittals as listed in paragraph 1.04 Submittals, Para. D. of this section.
- F. Whether by Certification or by Pre-Qualification, the steel fabricator shall have in their employ a specialty Engineer responsible for designing and detailing all structural connections and have responsible charge of shop drawing preparation. Fabricator shall anticipate and include in his bid all miscellaneous plates, angles, welds, or bolts necessary to accomplish the connection. Specialty Engineer shall sign and seal shop drawings indicating responsibility for connections only, and certifying that main members are as indicated on the contract documents. Connections shall be capable of resisting forces equal to the strength of the member being connected, when such forces are not shown on the plans.

1.04 SUBMITTALS

- A. Product Data: Submit producer's or manufacturer's specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).
1. Structural steel (each type).
 2. High-strength bolts (each type), including nuts and washers.
 3. Structural steel primer paint.
 4. Shrinkage-resistant grout.
- B. Shop Drawings: Submit shop drawings, including complete details and schedules for fabrication and assembly of structural steel members procedures and diagrams. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length, and type of each weld. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed by others.
- Shop drawings relating to the connections shall be signed and sealed by the fabricators engineer, who is registered in the project state.
- Any submittal or RFI shall be incorporated as part of the shop drawings. The first and all shop drawing submittals shall include the signature and seal of the Specialty Engineer, noting the purpose of the submittal.
- C. Test Reports: Submit copies of reports of tests conducted on shop and field bolted and welded connections. Include data on type(s) of tests conducted and test results.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- D. Qualification data for firms and persons specified in the AQuality Assurance@ Article to demonstrate their capabilities and experience. Include lists of completed projects with project name and address, name and address of Architect and Design Builder, and the name and address of the Specialty Engineer proposed for the work.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to site at such intervals to insure uninterrupted progress of work.
- B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not to delay work.
- C. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.
- D. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Metal Surfaces, General: For fabrication of work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes.
- G. Electrodes for Welding: Comply with AWS Code.
- H. Structural Steel Primer Paint: Fabricator's standard rust-inhibiting primer.
- I. Non-metallic Shrinkage-Resistant Grout: Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica, sands, portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CRD-C621.

Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

Euco N.S.; Euclid Chemical Co.
Masterflow 713; Master Builders
Five Star Grout; U.S. Grout Corp.

2.02 FABRICATION

- A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. Connections: Weld or bolt shop connections, as indicated. Weld field connections, except where bolted connections or other connections are indicated.
 - 1. Provide high-strength threaded fasteners for principal bolted connections, except where unfinished bolts are indicated.
 - 2. Provide unfinished threaded fasteners for only bolted connections of secondary framing members to primary members (including purlins, girts, and other framing members taking only nominal stresses) and for temporary bracing to facilitate erection.
- C. High-Strength Bolted Construction: Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" (RCRBSJ).
- D. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work. Build up welded door frames attached to structural steel framing. Weld exposed joints continuously and grind smooth. Plug weld steel bar stops to frames, except where shown removable. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10" o.c., unless otherwise indicated.
- E. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on final shop drawings. Provide threaded nuts welded to framing, and other specialty items as indicated to receive other work. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

2.03 SHOP PAINTING

- A. General: Shop paint structural steel, except those members or portions of members to be embedded in concrete or mortar or that is scheduled to receive sprayed on fireproofing. Paint embedded steel which is partially exposed on exposed portions and initial 2" of embedded areas only.
 - 1. Do not paint surfaces which are to be welded or high-strength bolted with friction-type connections.
 - 2. Apply 2 coats of paint to surfaces which are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.
- B. Surface Preparation: After inspection and before shipping, clean steel work to be painted. Remove loose rust, loose mill scale, and spatter, slag or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC) as follows:
 - 1. SP-2 "Hand Tool Cleaning"
 - 2. SP-3 "Power Tool Cleaning"
- C. Painting: Immediately after surface preparation, apply structural steel primer paint in accordance with manufacturer's instructions and at a rate to provide dry film thickness of not less than 1.5 mils. Use painting methods which result in full coverage of joints, corners, edges and exposed surfaces.

PART 3 - EXECUTION

3.01 ERECTION

- A. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignments of structures as erection proceeds.
- B. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.
- C. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations. Refer to Division 3 of these Specifications for anchor bolt installation requirements in concrete, and Division 4 for masonry installation.
- D. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.
- E. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to backing with grout.
- F. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure. For proprietary grout materials, comply with manufacturer's instructions.
- G. Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure within specified AISC tolerances. Employ surveyor to plumb columns with transit.
 - 2. Splice members only where indicated and accepted on shop drawings.
- H. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces.
- I. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds. Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.
- J. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members which are not under stress, as acceptable to Architect. Finish gas-cut sections equal to a

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

sheared appearance when permitted.

- K. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting. Apply by brush or spray to provide minimum dry film thickness of 1.5 mils.

3.02 QUALITY CONTROL

- A. Engage an independent testing and inspection agency to inspect high-strength bolted connections and welded connections and to perform tests and prepare test reports. Testing agency shall conduct and interpret tests and state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom. Provide access for testing agency to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.
- B. Shop Bolted Connections: Inspect in accordance with AISC specifications.
- C. Shop Welding: Inspect and test during fabrication of structural steel assemblies, as follows:
 - 1. Use Current Certified welders (certifications not over 1 year old) and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
 - 2. Perform visual inspection of all welds.
- D. Field Bolted Connections: Inspect in accordance with AISC specifications.
- E. Field Welding: Inspect and test during erection of structural steel as follows:
 - 1. Use Current Certified welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
- F. Completion Certification: Upon completion of erection, fabricator engineer shall certify that all connections have been completed in accordance with the shop drawings and contract documents.

END OF SECTION 051200

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 5: METALS
Section 05 40 00: Cold-Formed Metal Framing

PART 1 - GENERAL

1.01 RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.02 REFERENCE STANDARDS

- A. The following documents of the issue in effect date of material procurement, referred to thereafter by basic designation only form a part of this specification to the extent indicated by reference thereto.
1. American Iron and Steel Institute: Specifications for the Design of Cold-Formed Steel Structural Members.
 2. American Society of Testing materials: ASTM A-446 "Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, Physical (Structural) Quality." Grade C, Galvanizing: G-60 coating class.
 3. American Welding Society: AWS D1.0 "Code for Welding in Building Construction" and ANSIZ49.1 "Safety in Welding and Cutting".

1.03 DESCRIPTION: Furnish, fabricate, deliver and erect all light gage metal framing as shown on the drawings, or herein specified.

- A. Wind design shall be per ASCE 7-10. See drawings for wind design criteria.
- B. Deflection: Limit deflection due to Live Load (LL) only to L/360. Limit deflection due to Dead Load plus Live Load (DL+LL) to L/240.
- B. All bridging and bracing, including erection bracing, required for the finished product shall be designed and furnished. Bracing required for horizontal wind loads shall be designed for loads indicated on the plans and specifications, and as required by applicable codes
- C. All framing connections shall be designed and furnished. Connections shall be designed for all loading conditions; including uplift and reactions from horizontal wind load transfer.
- D. Design trusses to accommodate movement attributable to temperature changes within a range of 120 degrees F (67 degrees C) without damage or overstressing, sheathing failure, undue strain on fasteners and anchors, or other deleterious effects.

1.04 SUMMARY

- A. Types of cold-formed metal framing units include SJ-shaped load-bearing steel studs and cold formed steel trusses.
- B. Related Work Specified Elsewhere: Interior steel studs for gypsum drywall construction are specified in Section 09250.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1.05 SUBMITTALS:

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data and installation instructions for each item of cold-formed metal framing and accessories.
- C. Shop Drawings: Submit shop drawings showing shapes and dimensions of members to be used, including pitch, span, chamber configuration, and spacing for each type of configuration. Show all bearing and anchorage details. Specify and detail all supplemental framing, strapping, complete bracing, bracing clips, bridging and other required for proper installation and to satisfy all designed requirements. Shop drawings and calculations must be prepared by, and sealed, sealed and dated by, an engineer registered in the project state. Shop drawings bearing the seal, signature and date of the engineer registered in the project state responsible for their preparation shall be submitted for approval.

1.06 QUALITY ASSURANCE:

- A. Component Design: Calculate structural properties of studs and joists in accordance with American Iron and Steel Institute (AISI) "Specification for Design of Cold-Formed Steel Structural Members." Calculations shall be signed and sealed by a Specialty Engineer, registered in the project state.
- B. Welding: Use qualified welders and comply with American Welding Society (AWS) D1.3, "Structural Welding Code - Sheet Steel."
- C. Fire-Rated Assemblies: Where framing units are components of assemblies indicated for a fire-resistance rating, including those required for compliance with governing regulations, provide units that have been approved by governing authorities that have jurisdiction.

PART 2 - PRODUCTS

2.01 MANUFACTURERS: Subject to compliance with requirements, provide products of one of the following:

Alabama Metal Industries Corp.
Dale Industries, Inc.
Dietrich Industries, Inc.
Marino \ Ware.
Wheeling Corrugating Co.

Superior Steel Studs, Inc.
USG Industries
United States Steel
Unimast Incorp.

2.02 DELIVERY AND STORAGE: Protect metal framing units from rusting and damage. Deliver to project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade. Store off ground in a dry ventilated space or protect with suitable waterproof coverings.

2.03 METAL FRAMING

- A. System Components: Manufacturers' standard load-bearing steel studs of type, size, shape, and gage as indicated. With each type of metal framing required, provide manufacturer's standard, steel runners (tracks), blocking, lintels, clip angles, shoes,

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

reinforcements, fasteners, and accessories for applications indicated, as needed to provide a complete metal framing system.

B. Materials and Finishes:

1. Fabricate metal framing components of commercial quality steel sheet with a minimum yield point of 50,000 psi: ASTM A 446, A 570, or A 611.
2. Provide galvanized finish to metal framing components complying with ASTM A 525 for minimum G 60 coating.
3. Studs: Manufacturer's standard load-bearing steel studs of size, shape, and gage indicated on drawings. Unless indicated otherwise on the drawings, stud flange width shall be 1.625" with flange return lip.

2.04 FABRICATION

- A. General: Framing components may be prefabricated into assemblies before erection. Fabricate panels or members plumb, square, true to line, and braced against racking with joints welded. Perform lifting of prefabricated units to prevent damage or distortion.
- B. Fastenings: Attach similar components by welding, bolting, or using screw fasteners. Attach dissimilar components by welding, bolting, or screw fasteners, as standard with manufacturer.
- C. Wire tying of framing components is not permitted.
- D. All framing components shall be cut neatly to fit against abutting members.
- D. Provide all angles, clips, and other miscellaneous pieces necessary to attach other materials to light gauge framing.
- E. All components shall be set square in line and shall be held firmly in position until properly fastened.
- F. Finished assemblies shall be free from twist, bends, or open joints with all members straight, square, and true to line.
- J. All Light Gage trusses shall be shop fabricated. Field fabrication will not be allowed.

PART 3 - EXECUTION

3.01 INSTALLATION: General: Install metal framing systems in accordance with manufacturer's printed or written instructions and recommendations.

- A. The Contractor is responsible for checking dimensions and assuring fit of all members before erection begins.
- B. All work shall be erected plumb and level and to dimensions, spacing, and elevations indicated on drawings.
- C. Members shall be of size and spacing shown on the approved shop drawings.
- D. Provide temporary bracing as required.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- E. Install permanent bracing and related components to withstand live and dead loads, wind uplift, material wind loads, and to comply with other indicated requirements.
 - F. All light gauge steel framing shall be erected by approval methods using equipment of adequate capacity to safely perform the work.
- 3.02 RUNNER TRACKS: Install continuous tracks sized to match studs. Align tracks accurately to layout at base and tops of studs. Secure tracks as shown on drawings, or if not shown, as recommended by stud manufacturer for type of construction involved. Do not exceed 24 inches o.c. spacing for nail or power-driven fasteners or 16 inches o.c. for other types of attachment. Provide fasteners at corners and ends of tracks.
- 3.03 SET STUDS PLUMB, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.
- 3.04 WHERE STUD SYSTEM abuts structural columns or walls, including masonry walls, anchor ends of stiffeners to supporting structure.
- 3.05 INSTALL SUPPLEMENTARY FRAMING, blocking, and bracing in metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with stud manufacturer's recommendations and industry standards in each case, considering weight or loading resulting from item supported.
- 3.06 INSTALLATION OF WALL STUDS: Secure studs to top and bottom runner tracks by either welding or screw fastening at both inside and outside flanges.
- 3.07 FRAME WALL OPENINGS larger than 2 feet square with double stud at each jamb of frame except where more than two are either shown or indicated in manufacturer's instructions or on drawings. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with stud shoes or by welding, and space jack studs same as full-height studs of wall. Secure stud system wall opening frame in manner indicated.
- A. Frame both sides of expansion and control joints, as shown for wall system, with a separate stud and do not bridge the joint with components of stud system.
 - B. Install horizontal stiffeners in stud system, spaced (vertical distance) at not more than 4'-0" o.c. Weld at each inter-section.
- 3.08 INSTALLATION OF JOISTS AND TRUSSES: Install level, straight, and plumb, complete with bracing and reinforcing as indicated on drawings. Provide not less than 1-1/2-inch end bearing.
- A. Reinforce ends with end clips, steel hangers, steel angle clips, steel stud section, or as otherwise recommended by joist manufacturer.
 - B. Where required, reinforce joists at interior supports with single short length of joist section located directly over interior support, snap-on shoe, 30 percent side-piece lapped reinforcement, or other method recommended by joist manufacturer.
 - C. Secure joists to interior support systems to prevent lateral movement of bottom flange.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- 3.09 Field Painting: Touch-up damaged shop-applied protective coatings. Use compatible primer for prime-coated surfaces; use galvanizing repair system for galvanized surfaces.

END OF SECTION 054000

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 5: METALS
Section 05 50 00: Metal Fabrications

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section.

1.2 SUMMARY

- A. This Section includes the following metal fabrications:
 - 1. Rough hardware.
 - 2. Steel ladders
 - 3. Loose bearing and leveling plates.
 - 4. Loose steel lintels.
 - 5. Shelf and relieving angles.
 - 6. Miscellaneous framing anchors and supports for the following:
 - a. Overhead doors and rolling fire shutters.
 - b. Applications where framing and supports are not specified in other sections.
 - c. Loose setting angles and miscellaneous anchors for precast concrete.
 - 7. Extruded nosings at poured in place concrete stairs..
 - 8. Pipe bollards.
 - 9. Trench frames and solid checkered top.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 5 Section "Metal Stairs" for metal framed stairs with metal pan, metal plate, or grating treads.
 - 2. Division 5 Section "Pipe and Tube Railings" for metal pipe and tube handrails and railing systems.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract.
- B. Product data for nonslip aggregates and nonslip aggregate surface finishes, prefabricated building columns, cast nosings, treads and thresholds, steel floor plate, paint products, and grout.
- C. Shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.
- D. Samples representative of materials and finished products as may be requested by Architect.

MEDICAL, PSYCHIATRIC,
MINIMUM SECURITY HOLDING UNITS
ADDITIONS TO THE TUSCALOOSA COUNTY JAIL
TUSCALOOSA, ALABAMA

- E. Welder certificates signed by General Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.
- F. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include a list of completed projects with project name, addresses, names of architects and owners, and other information specified.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firm experienced in producing metal fabrications similar to those indicated for this Project with a record of successful in-service performance, and with sufficient production capacity to produce required units without delaying the Work.
- B. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel," AWS D1.2 "Structural Welding Code--Aluminum," and AWS D1.3 "Structural Welding Code--Sheet Steel."
 - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating products without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

PART 2 - PRODUCTS

2.1 FERROUS METALS

- A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Rolled Steel Floor Plates: ASTM A 786/A 786M.
- D. Steel Tubing: Product type (manufacturing method) and as follows:
 - 1. Cold-Formed Steel Tubing: ASTM A 500.
 - 2. Hot-Formed Steel Tubing: ASTM A 501.
 - a. For exterior installations and where indicated, provide tubing with hot-dip galvanized coating per ASTM A 53.

MEDICAL, PSYCHIATRIC,
MINIMUM SECURITY HOLDING UNITS
ADDITIONS TO THE TUSCALOOSA COUNTY JAIL
TUSCALOOSA, ALABAMA

- E. Steel Pipe: ASTM A 53, standard weight (schedule 40), unless otherwise indicated, or another weight required by structural loads.
 - 1. Black finish, unless otherwise indicated.
 - 2. Galvanized finish for exterior installations and where indicated.
- F. Gray-Iron Castings: ASTM A 48, Class 30.
- G. Malleable-Iron Castings: ASTM A 47, Grade 32510 (ASTM A 47M, Grade 22010).
- H. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as required, hot-dip galvanized per ASTM A 153.
- I. Welding Rods and Bare Electrodes: Select according to AWS specifications for the metal alloy to be welded.

2.2 PAINT

- A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements of FS TT-P-664, selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.
- C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

2.3 FASTENERS

- A. General: Provide plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating, for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568, Property Class 4.6), with hex nuts, ASTM A 563 (ASTM A 563M), and, where indicated, flat washers.
- C. Machine Screws: ANSI B18.6.3.
- D. Lag Bolts: ANSI B18.2.1 (ANSI B18.2.3.8M).
- E. Wood Screws: Flat head, carbon steel, ANSI B18.6.1.

MEDICAL, PSYCHIATRIC,
MINIMUM SECURITY HOLDING UNITS
ADDITIONS TO THE TUSCALOOSA COUNTY JAIL
TUSCALOOSA, ALABAMA

- F. Plain Washers: Round, carbon steel, ANSI B18.22.1 (ANSI B18.22M).
- G. Lock Washers: Helical, spring type, carbon steel, ANSI B18.21.1.
- H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
 - 1. Material: Carbon steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material: Group 1 alloy 304 or 316 stainless-steel bolts and nuts complying with ASTM F 593 (ASTM F 738M) and ASTM F 594 (ASTM F 836M).
- I. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as required.

2.4 GROUT

- A. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.
- B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- C. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Nonshrink, Metallic Grouts:
 - a. Supreme Plus; Cormix Construction Chemicals.
 - b. Hi Mod Grout; Euclid Chemical Co.
 - c. Embecco 885 and 636; Master Builders Technologies, Inc.
 - d. Ferrolith G Redi-Mix and G-NC; Sonneborn Building Products--ChemRex, Inc.
 - e. Met-ox; The Spray-Cure Company.
 - 2. Nonshrink, Nonmetallic Grouts:
 - a. B-6 Construction Grout; W. R. Bonsal Co.
 - b. Diamond-Crete Grout; Concrete Service Materials Co.
 - c. Supreme; Cormix Construction Chemicals.
 - d. Sure-grip High Performance Grout; Dayton Superior Corp.
 - e. Euco N-S Grout; Euclid Chemical Co.
 - f. Five Star Grout; Five Star Products.
 - g. Vibropruf #11; Lambert Corp.
 - h. Crystex; L & M Construction Chemicals, Inc.
 - i. Masterflow 928 and 713; Master Builders Technologies, Inc.
 - j. Sealtight 588 Grout; W. R. Meadows, Inc.
 - k. SonogROUT 14; Sonneborn Building Products--ChemRex, Inc.
 - l. Kemset; The Spray-Cure Company.

2.5 CONCRETE FILL

MEDICAL, PSYCHIATRIC,
MINIMUM SECURITY HOLDING UNITS
ADDITIONS TO THE TUSCALOOSA COUNTY JAIL
TUSCALOOSA, ALABAMA

- A. Concrete Materials and Properties: Comply with requirements of Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless higher strengths are indicated.

2.6 FABRICATION, GENERAL

- A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.
- B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
- C. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.
 - 1. Temperature Change (Range): 100 deg F (55.5 deg C).
- D. Shear and punch metals cleanly and accurately. Remove burrs.
- E. Ease exposed edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- F. Remove sharp or rough areas on exposed traffic surfaces.
- G. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.
- H. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

MEDICAL, PSYCHIATRIC,
MINIMUM SECURITY HOLDING UNITS
ADDITIONS TO THE TUSCALOOSA COUNTY JAIL
TUSCALOOSA, ALABAMA

- K. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- L. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.7 ROUGH HARDWARE

- A. Furnish bent, or otherwise custom-fabricated, bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 Sections.
- B. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts that bear on wood structural connections, and furnish steel washers elsewhere.

2.8 STEEL LADDERS

- A. General: Fabricate ladders for the locations shown, with dimensions, spacings, details, and anchorages as indicated. Comply with requirements of ANSI A14.3.
- B. Siderails: Continuous, steel, 1/2-by-2-1/2-inch (12-by-64-mm) flat bars, with eased edges, spaced 18 inches (460 mm) apart.
- C. Bar Rungs: 3/4-inch- (19-mm-) diameter steel bars, spaced 12 inches (300 mm) o.c.
- D. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.
- E. Support each ladder at top and bottom and at intermediate points spaced not more than 5 feet (1.5 m) o.c. with welded or bolted steel brackets.
 - 1. Size brackets to support design dead and live loads indicated and to hold centerline of ladder rungs clear of the wall surface by not less than 7 inches (180 mm).
 - 2. Extend side rails 42 inches (1.1 m) above top rung, and return rails to wall or structure unless other secure handholds are provided. If the adjacent structure does not extend above the top rung, goose-neck the extended rails back to the structure to provide secure ladder access.
- F. Provide nonslip surfaces on top of each rung, either by coating the rung with aluminum-oxide granules set in epoxy-resin adhesive, or by using a type of manufactured rung that is filled with aluminum-oxide grout.

2.9 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of the required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

2.10 LOOSE STEEL LINTELS

- A. Fabricate loose structural steel lintels from steel angles and shapes of size indicated for openings

MEDICAL, PSYCHIATRIC,
MINIMUM SECURITY HOLDING UNITS
ADDITIONS TO THE TUSCALOOSA COUNTY JAIL
TUSCALOOSA, ALABAMA

and recesses in masonry walls and partitions at locations indicated.

- B. Weld adjoining members together to form a single unit where indicated.
- C. Size loose lintels for equal bearing of 1 inch per foot (85 mm per meter) of clear span but not less than 8 inches (200 mm) bearing at each side of openings, unless otherwise indicated.
- D. Galvanize loose steel lintels located in exterior walls.

2.11 SHELF AND RELIEVING ANGLES

- A. Fabricate shelf and relieving angles from steel angles of sizes indicated and for attachment to concrete framing. Provide slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and not more than 24 inches (600 mm) o.c., unless otherwise indicated.
- B. For cavity walls, provide vertical channel brackets to support shelf/relieving angles from back-up masonry and concrete. Align expansion joints in angles with indicated control and expansion joints in cavity wall exterior wythe.
- C. Galvanize shelf angles to be installed on exterior concrete framing.
- D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.12 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports for applications indicated that are not a part of structural steel framework as required to complete the Work.
- B. Fabricate units to sizes, shapes, and profiles indicated and required to receive other adjacent construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 - 1. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.
 - a. Except as otherwise indicated, space anchors 24 inches (600 mm) o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches (32 mm) wide by 1/4 inch (6 mm) thick by 8 inches (200 mm) long.
- C. Galvanize miscellaneous framing and supports in the following locations:
 - 1. Exterior locations.
 - 2. Interior locations where indicated.

2.13 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices wherever possible.

MEDICAL, PSYCHIATRIC,
MINIMUM SECURITY HOLDING UNITS
ADDITIONS TO THE TUSCALOOSA COUNTY JAIL
TUSCALOOSA, ALABAMA

- B. Provide cutouts, fittings, and anchorages as required to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 inches (150 mm) from each end, 6 inches (150 mm) from corners, and 24 inches (600 mm) o.c., unless otherwise indicated.
- C. Galvanize miscellaneous steel trim in the following locations:
 - 1. Exterior locations.
 - 2. Interior locations where indicated.

2.14 STRUCTURAL STEEL DOOR FRAMES

- A. Fabricate steel door frames from structural shapes and bars of size and to dimensions indicated, fully welded together, with 5/8-by-1-1/2-inch (16-by-38-mm) steel bar stops, unless otherwise indicated. Plug-weld built-up members and continuously weld exposed joints. Secure removable stops to frame with countersunk machine screws, uniformly spaced at not more than 10 inches (250 mm) o.c. Reinforce frames and drill and tap as required to accept finish hardware.
- B. Provide steel strap anchors for securing door frames into adjoining concrete or masonry, using 1/8-by-2-inch (3-by-50-mm) straps of the length required for a minimum 8-inch (200-mm) embedment, unless otherwise indicated. Weld anchors to frame jambs no more than 12 inches (300 mm) from both bottom and head of frame and space anchors not more than 30 inches (750 mm) apart.
- C. Extend bottom of frames to floor elevation indicated with steel angle clips welded to frames for anchoring frame to floor with expansion shields and bolts.
- D. Galvanize frames and anchors in the following locations:
 - 1. Exterior locations.
 - 2. Interior locations where indicated.
- E. At Exterior HM Frames, coat inside with asphalt paint from floor to 12”.

2.15 EXTRUDED NOSINGS AND TREADS

- A. Fabricate units of material, sizes, and configurations indicated. Provide extruded aluminum units with abrasive filler consisting of aluminum-oxide or silicon-carbide grits, or a combination of both, in an epoxy-resin binder. Furnish in lengths as required to accurately fit each opening or conditions.
 - 1. Provide ribbed units, with abrasive filler strips projecting 1/16 inch (1.5 mm) above the aluminum extrusion.
 - 2. Provide solid abrasive type units without ribs.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. American Safety Tread Co., Inc.
 - 2. Amstep Products.
 - 3. Armstrong Products, Inc.

MEDICAL, PSYCHIATRIC,
MINIMUM SECURITY HOLDING UNITS
ADDITIONS TO THE TUSCALOOSA COUNTY JAIL
TUSCALOOSA, ALABAMA

4. Balco/Metalines, Inc.
 5. Safe-T-Metal Co.
 6. Wooster Products Inc.
- C. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with the manufacturer.
- D. Drill for mechanical anchors with countersunk holes located not more than 4 inches (100 mm) from ends and not more than 12 inches (300 mm) o.c., evenly spaced between ends, unless otherwise indicated. Provide closer spacing if recommended by the manufacturer.
1. Provide 2 rows of holes for units over 5 inches (125 mm) wide, with 2 holes aligned at ends and staggered intermediate holes.

2.16 PIPE BOLLARDS

- A. Fabricate pipe bollards from Schedule 80 steel pipe. Cap bollards with 1/4-inch (6.4-mm) minimum steel plate.
- B. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch- (6.4-mm-) thick steel plate welded to bottom of sleeve.
- C. Coat Bollard from bottom to 1/2" above grade with asphalt paint.

2.17 FINISHES, GENERAL

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designing finishes.
- B. Finish metal fabrications after assembly.

2.18 STEEL AND IRON FINISHES

- A. Galvanizing: For those items indicated for galvanizing, apply zinc coating by the hot-dip process complying with the following requirements:
1. ASTM A 153 for galvanizing iron and steel hardware.
 2. ASTM A 123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch (0.76 mm) thick or thicker.
- B. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
1. Exteriors (SSPC Zone 1B): SSPC-SP 6 "Commercial Blast Cleaning."
 2. Interiors (SSPC Zone 1A): SSPC-SP 3 "Power Tool Cleaning."
- C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise

MEDICAL, PSYCHIATRIC,
MINIMUM SECURITY HOLDING UNITS
ADDITIONS TO THE TUSCALOOSA COUNTY JAIL
TUSCALOOSA, ALABAMA

indicated. Comply with requirements of SSPC-PA 1 "Paint Application Specification No. 1" for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.19 TRENCH FRAME WITH SOLID CHECKERED COVER

- A. Provide at sidewalk where shown on drawings equal to Neenah Foundry Company R-4991 Light Duty.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installing anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.
- B. Center nosings on tread widths with noses flush with riser faces and tread surfaces.
- C. Set sleeves in concrete with tops flush with finish surface elevations. Protect sleeves from water and concrete entry.

3.2 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.
- D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop-welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.
- E. Field Welding: Comply with the following requirements:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.

MEDICAL, PSYCHIATRIC,
MINIMUM SECURITY HOLDING UNITS
ADDITIONS TO THE TUSCALOOSA COUNTY JAIL
TUSCALOOSA, ALABAMA

- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.3 SETTING LOOSE PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.
- B. Set loose leveling and bearing plates on wedges or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.
 - 1. Use nonshrink, metallic grout in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 INSTALLING NOSINGS, TREADS, AND THRESHOLDS

- A. Install with anchorage system indicated to comply with manufacturer's recommendations.
- B. Seal thresholds exposed to exterior with elastomeric sealant complying with Division 7 Section "Joint Sealants" to provide a watertight installation.

3.5 INSTALLING PIPE BOLLARDS

- A. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. After bollards have been inserted into sleeves, fill annular space between bollard and sleeve solidly with nonshrink, nonmetallic grout, mixed and placed to comply with grout manufacturer's directions.
- B. Fill bollards solidly with concrete, mounding top surface.

3.6 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a 2.0-mil (0.05-mm) minimum dry film thickness.
- B. For galvanized surfaces, clean welds, bolted connections, and abraded areas, and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION 05 50 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 5: METALS
Section 05 51 00: Metal Stairs

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section.

1.2 SUMMARY

- A. This Section includes the following:
1. Straight run, steel-framed stairs.
 2. Steel pipe handrails and railing systems attached to metal stairs.
 3. Steel pipe handrails attached to walls adjacent to metal stairs.
 4. Tubular Steel Access Ladder
- B. Related Sections: The following Sections contain requirements that relate to this Section.
1. Division 5 Section "Pipe and Tube Railings" for pipe and tube handrails and railing systems.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Engineer, fabricate, and install steel stairs to withstand the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each component of steel stairs.
1. Treads of Steel Stairs: Capable of withstanding a uniform load of 100 lbf per sq. ft. (4.8 kN/sq. m) or a concentrated load of 300 lbf (1.35 kN) on an area of 4 sq. inches (26 sq. cm) located in the center of the tread, whichever produces the greater stress.
 2. Platforms of Steel Stairs: Capable of withstanding a uniform load of 100 lbf per sq. ft. (4.8 kN/sq. m).
 3. Stair Framing: Capable of withstanding stresses resulting from loads specified above as well as stresses resulting from railing system loads.
- B. Structural Performance of Handrails and Railing Systems: Engineer, fabricate, and install handrails and railing systems to comply with requirements of ASTM E 985 for structural performance based on the following:
1. Testing performed according to ASTM E 894 and E 935.
 2. Structural computations.
- C. Structural Performance: Engineer, fabricate, and install handrails and railing systems to withstand the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each of the respective components of each metal fabrication.
1. Top Rail of Guardrail Systems: Capable of withstanding the following loads applied as

MEDICAL, PSYCHIATRIC,
MINIMUM SECURITY HOLDING UNITS
ADDITIONS TO THE TUSCALOOSA COUNTY JAIL
TUSCALOOSA, ALABAMA

indicated:

- a. Concentrated load of 200 lbf (890 N) applied at any point and in any direction.
 - b. Uniform load of 50 lbf per linear foot (730 N/m) applied horizontally and concurrently with uniform load of 100 lbf per linear foot (1460 N/m) applied vertically downward.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.
2. Handrails Not Serving as Top Rails: Capable of withstanding the following loads applied as indicated:
- a. Concentrated load of 200 lbf (890 N) applied at any point and in any direction.
 - b. Uniform load of 50 lbf per linear foot (730 N/m) applied in any direction.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.
3. Infill Area of Guardrail Systems: Capable of withstanding a horizontal concentrated load of 200 lbf (890 N) applied to one sq. ft. (0.09 sq. m) at any point in the system including panels, intermediate rails, balusters, or other elements composing the infill area.
- a. Above load need not be assumed to act concurrently with loads on top rails of railing systems in determining stress on guard.

1.4 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract.
- B. Product data for metal stairs, prefilled metal pan stair treads, nonslip aggregates and nonslip aggregate surface finishes, cast nosings, extruded nosings, steel floor plate, paint products, and grout.
- C. Shop drawings detailing fabrication and installation of steel stairs. Include plans, elevations, sections, and details of steel stairs and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other sections.
 1. For installed steel stairs indicated to comply with certain design loadings, include structural analysis data sealed and signed by the qualified professional engineer who was responsible for their preparation.
- D. Welder certificates signed by General Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.
- E. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firm experienced in producing steel stairs similar to those indicated for this Project with a record of successful in-service performance and with sufficient production capacity to produce required units without delaying the Work.
- B. Installer Qualifications: Arrange for steel stair installation specified in this Section by the same firm that fabricated them.

MEDICAL, PSYCHIATRIC,
MINIMUM SECURITY HOLDING UNITS
ADDITIONS TO THE TUSCALOOSA COUNTY JAIL
TUSCALOOSA, ALABAMA

- C. Engineer Qualifications: A professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of the kind indicated that have resulted in the installation of metal stairs (including handrails and railing systems) similar to this Project in material, design, and extent and that have a record of successful in-service performance.
- D. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel" and AWS D1.3 "Structural Welding Code--Sheet Steel."
 - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering preassembled stair units that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Alfab, Inc.
 - 2. American Metal Works, Inc.
 - 3. American Stair Corp., Inc.
 - 4. The Sharon Companies, Ltd.
 - 5. Safety Rail Company, LLC.

2.2 FERROUS METALS

- A. Metal Surfaces, General: For surfaces exposed to view in the completed Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, roughness, or, for steel sheet, variations in flatness exceeding those permitted by referenced standards for stretcher-leveled sheet.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Steel Tubing: Product type (manufacturing method) and as follows:
 - 1. Cold-Formed Steel Tubing: ASTM A 500.
 - 2. Hot-Formed Steel Tubing: ASTM A 501.
 - a. For all installations and where indicated, provide tubing with hot-dip galvanized coating per ASTM A 53.
- D. Steel Pipe: ASTM A 53, standard weight (schedule 40), unless otherwise indicated, or another weight required by structural loads.
 - 2. Galvanized finish for all installations and where indicated.
- E. Rolled Steel Floor Plate: ASTM A 786/A 786M.

MEDICAL, PSYCHIATRIC,
MINIMUM SECURITY HOLDING UNITS
ADDITIONS TO THE TUSCALOOSA COUNTY JAIL
TUSCALOOSA, ALABAMA

- F. Steel Bars for Gratings: ASTM A 569/A 569M or ASTM A 36/A 36M.
- G. Wire Rod for Grating Cross Bars: ASTM A 510 (ASTM A 510M).
- H. Uncoated Structural Steel Sheet: Product type (manufacturing method), quality, and grade as follows:
 - 1. Cold-Rolled Structural Steel Sheet: ASTM A 611, grade as follows:
 - a. Grade A, unless otherwise indicated or required by design loading.
 - 2. Hot-Rolled Structural Steel Sheet: ASTM A 570/A 570M, grade as follows:
 - a. Grade 30, unless otherwise indicated or required by design loading.
- I. Uncoated Steel Sheet: Commercial quality, product type (method of manufacture) as follows:
 - 1. Cold-Rolled Steel Sheet: ASTM A 366/A 366M.
 - 2. Hot-Rolled Steel Sheet: ASTM A 569/A 569M.
- J. Galvanized Steel Sheet: Quality as follows:
 - 1. Structural Quality: ASTM A 446/A 446M; Grade A, G 90 (Z 275) coating, unless otherwise indicated, or unless another grade is required for design loading.
 - 2. Commercial Quality: ASTM A 526/A 526M, G 90 (Z 275) coating designation, unless otherwise indicated.
- K. Welding Rods and Bare Electrodes: Select according to AWS specifications for the metal alloy to be welded.

2.3 FASTENERS

- A. General: Provide plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating, for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head type, ASTM A 307, Grade A (ASTM F 568, Property Class 4.6), with hex nuts, ASTM A 563 (ASTM A 563M), and, where indicated, flat washers.
- C. Machine Screws: ANSI B18.6.3 (ANSI B18.6.7M).
- D. Lag Bolts: ANSI B18.2.1 (ANSI B18.2.3.8M).
- E. Plain Washers: Round, carbon steel, ANSI B18.22.1 (ANSI B18.22M).
- F. Lock Washers: Helical, spring type, carbon steel, ANSI B 18.21.1.
- G. Expansion Anchors: Anchor bolt and sleeve assemblies of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

MEDICAL, PSYCHIATRIC,
MINIMUM SECURITY HOLDING UNITS
ADDITIONS TO THE TUSCALOOSA COUNTY JAIL
TUSCALOOSA, ALABAMA

1. Material: Carbon steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Group 1 alloy 304 or 316 stainless-steel bolts and nuts complying with ASTM F 593 (ASTM F 738M) and ASTM F 594 (ASTM F 836M).

2.4 PAINT

- A. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.

2.5 CONCRETE FILL AND REINFORCING MATERIALS

- A. Concrete Materials and Properties: Comply with requirements of Division 3 Section "Cast-in-Place Concrete" for normal-weight, ready-mixed concrete with a minimum 28-day compressive strength of 2,500 psi (17 MPa), unless higher strengths indicated.
- B. Nonslip Aggregate Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rust-proof and non-glazing; unaffected by freezing, moisture, or cleaning materials.
- C. Reinforcing Bars: ASTM A 615 (ASTM A 615M), Grade 60 (Grade 400), unless otherwise indicated.

2.6 FABRICATION, GENERAL

- A. Form steel stairs from materials of size, thickness, and shapes indicated, but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support.
- B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
- C. Shear and punch metals cleanly and accurately.
- D. Remove sharp or rough areas on exposed surfaces.
- E. Ease exposed edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- F. Weld corners and seams continuously to comply with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and welded surface matches contours of adjoining surfaces.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head

MEDICAL, PSYCHIATRIC,
MINIMUM SECURITY HOLDING UNITS
ADDITIONS TO THE TUSCALOOSA COUNTY JAIL
TUSCALOOSA, ALABAMA

(countersunk) screws or bolts. Locate joints where least conspicuous.

- H. Shop Assembly: Preassemble in shop to greatest extent possible to minimize field splicing and assembly. Use connections that maintain structural value of joined pieces. Clearly mark units for field assembly and coordinated installation.
- I. Fabricate joints that will be exposed to weather in a manner to exclude water or provide weep holes where water may accumulate.

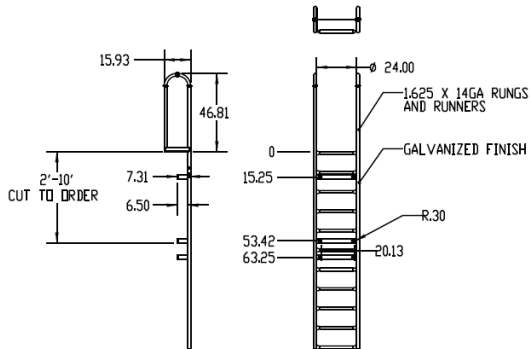
2.7 STEEL-FRAMED STAIRS

- A. General: Construct stairs to conform to sizes and arrangements indicated. Join pieces together by welding, unless otherwise indicated. Provide complete stair assemblies, including metal framing, hangers, columns, handrails, railing systems, newels, balusters, struts, clips, brackets, bearing plates, or other components necessary for the support of stairs and platforms, and as required to anchor and contain the stairs on the supporting structure.
 - 1. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM "Metal Stair Manual" for class of stair designated, except where more stringent requirements are indicated.
 - a. Commercial class, unless otherwise indicated.
- B. Stair Framing: Fabricate stringers of structural steel channels, plates, or a combination thereof, as indicated. Provide closures for exposed ends of stringers. Construct platforms of structural steel channel headers and miscellaneous framing members as indicated. Bolt or weld headers to stringers; and bolt or weld newels and framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finish surfaces.
 - 1. Where masonry walls support steel stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- C. Metal Pan Risers, Subtreads, and Subplatforms: Shape metal pans for risers and subtreads to conform to configuration shown. Provide thicknesses of structural steel sheet for metal pans indicated, but not less than that required, to support total design loading.
 - 1. Form metal pans of uncoated cold-rolled steel sheet, unless otherwise indicated.
 - 2. Directly weld risers and subtreads to stringers; locate welds on side of metal pans to be concealed by concrete fill.
 - 3. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
 - 4. Shape metal pans to include nosing integral with riser.
 - 5. Provide subplatforms of configuration and construction indicated; if not indicated, of same metal as risers and subtreads, in thicknesses required to support design loading. Attach subplatform to platform framing members with welds.
 - a. Smooth Soffit Construction: Construct subplatforms with smooth soffits.
- D. Steel Floor Plate Treads and Platforms: Provide raised pattern steel floor plate in pattern indicated or, if not indicated, as selected from manufacturer's standard patterns. All raised pattern steel floor plates and stair treads shall be galvanized G90.

MEDICAL, PSYCHIATRIC,
MINIMUM SECURITY HOLDING UNITS
ADDITIONS TO THE TUSCALOOSA COUNTY JAIL
TUSCALOOSA, ALABAMA

2.75 TUBULAR STEEL ACCESS LADDER

- A. Cut to Order tubular steel access ladder by Safety Rail Company, LLC, basis of design or prior approved equivalent.
- B. Rungs and Runners shall be 1.625 x 14ga, Galvanized finish.



2.8 FINISHES

- A. General: Fully Galvanize metal stairs and all components after assembly.
 - 1. Comply with NAAMM "Metal Finishes Manual" for recommendations on application and designations of finishes.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installing anchorages, including concrete inserts, weld plates, and anchor bolts. Coordinate delivery of such items to Project site.

3.2 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing steel stairs to in-place construction; include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors as required.

MEDICAL, PSYCHIATRIC,
MINIMUM SECURITY HOLDING UNITS
ADDITIONS TO THE TUSCALOOSA COUNTY JAIL
TUSCALOOSA, ALABAMA

- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing steel stairs. Set units accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- C. Install steel stairs by welding stair framing to steel structure or to weld plates cast into concrete, except where otherwise indicated.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop-welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are intended for bolted field connections.
- F. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

3.3 INSTALLING STEEL STAIRS WITH GROUTED BASE PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base plates.
- B. Set steel stair base plates on wedges or other adjustable devices. After the stairs have been positioned and aligned, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.
 - 1. Use nonmetallic, nonshrink grout, unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 INSTALLING STEEL PIPE RAILINGS AND HANDRAILS

- A. Adjust handrails and railing systems prior to anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loadings. Plumb posts in each direction. Secure posts and railing ends to building construction as follows:
 - 1. Anchor posts to steel by welding directly to steel supporting members.
 - 2. Anchor handrail ends into concrete and masonry with steel round flanges welded to rail ends and anchored into wall construction with drilled-in expansion anchors.
- B. Secure handrails to wall with wall brackets and end fittings. Provide bracket with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets and wall return fittings to building construction as follows:

MEDICAL, PSYCHIATRIC,
MINIMUM SECURITY HOLDING UNITS
ADDITIONS TO THE TUSCALOOSA COUNTY JAIL
TUSCALOOSA, ALABAMA

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
2. Use type of bracket with predrilled hole for exposed bolt anchorage.
3. For concrete and solid masonry anchorage, use drilled-in expansion anchor.
4. For hollow masonry anchorage, use toggle bolts having square heads.
5. For wood stud partitions, use lag bolts set into wood backing between studs. Coordinate with stud installations for accurate location of backing members.
6. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed anchors using self-tapping screws of size and type required to support structural loads.

3.5 ADJUSTING AND CLEANING

Touchup of Finish:

- C. For galvanized surfaces, clean welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION 05 51 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 5: METALS
Section 05 52 13: Pipe and Tube Railings

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Steel pipe and tube handrails and railing systems at balconies and mechanical catwalks and raised platforms.

1.3 DEFINITIONS

- A. Definitions in ASTM E 985 for railing-related terms apply to this Section.

1.4 PERFORMANCE REQUIREMENTS

- A. General: In engineering handrail and railing systems to withstand structural loads indicated, determine allowable design working stresses of materials based on the following:
 - 1. Cold-Formed Structural Steel: AISI "Specification for the Design of Cold-Formed Steel Structural Members."
- B. Structural Performance of Handrails and Railing Systems: Engineer, fabricate, and install handrails and railing systems to comply with requirements of ASTM E 985 for structural performance based on the following:
 - 1. Testing performed according to ASTM E 894 and E 935.
 - 2. Structural computations.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.5 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract.
- B. Product data for mechanically connected handrails and railing systems, each kind of fitting, grout, anchoring cement, and paint products.
- C. Shop drawings showing fabrication and installation of handrails and railing systems including plans, elevations, sections, details of components, and attachments to other units of Work.

1.6 QUALITY ASSURANCE

- A. Single-Source Responsibility: Obtain handrails and railing systems of each type and material from

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

a single manufacturer.

1.7 STORAGE

- A. Store handrails and railing systems inside a well-ventilated area, away from uncured concrete and masonry and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.
 - 1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating handrails and railing systems without field measurements. Coordinate other construction to ensure that actual dimensions correspond to guaranteed dimensions.

PART 2 - PRODUCTS

2.1 METALS

- A. General: Provide metals free from surface blemishes where exposed to view in the finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, stains, discolorations, or other imperfections on finished units are not acceptable.
- B. Steel and Iron: Provide steel and iron in the form indicated, complying with the following requirements:
 - 1. Steel Pipe: ASTM A 53; finish, type, and weight class as follows:
 - a. Type F, or Type S, Grade A, standard weight (schedule 40), unless otherwise indicated, or another weight, type, and grade required by structural loads.
 - 2. Steel Tubing: Product type (manufacturing method) and other requirements as follows:
 - a. Cold-Formed Steel Tubing: ASTM A 500, grade as indicated below:
 - 1) Grade A, unless otherwise indicated or required by structural loads.
 - 3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Brackets, Flanges, and Anchors: Cast or formed metal of the same material and finish as supported rails, unless otherwise indicated.

2.2 WELDING MATERIALS, FASTENERS, AND ANCHORS

- A. Welding Electrodes and Filler Metal: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of the type, grade, and class required to produce connections that are suitable for anchoring railings to other types of construction indicated and capable of withstanding design loadings.
 - 1. For steel railings and fittings, use plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2.3 PAINT

- A. Shop Primers: Provide primers to comply with applicable requirements of Division 9 Section "Painting."
- B. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer, selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure, complying with performance requirements of FS TT-P-664.

2.4 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- B. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Nonshrink, Nonmetallic Grouts:
 - a. B-6 Construction Grout; W.R. Bonsal Co.
 - b. Diamond-Crete Grout; Concrete Service Materials Co.
 - c. Supreme; Cormix Construction Chemicals.
 - d. Sure-grip High Performance Grout; Dayton Superior Corp.
 - e. Euco N-S Grout; Euclid Chemical Co.

2.5 FABRICATION

- A. General: Fabricate handrails and railing systems to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of hollow members, post spacings, and anchorage, but not less than those required to support structural loads.
- B. Welded Connections: Fabricate handrails and railing systems for connection of members by welding. For connections made during fabrication, weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At tee and cross intersections, cope ends of intersecting members to fit contour of pipe or tube to which end is joined, and weld all around.
 - 5. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- C. Brackets, Flanges, Fittings, and Anchors: Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings, and anchors to interconnect handrail and railing system members to other construction.

2.6 STEEL FINISHES

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. For nongalvanized steel handrails and railing systems, provide nongalvanized ferrous metal fittings, brackets, fasteners, and sleeves, except provide galvanized anchors where embedded in exterior masonry and concrete construction.
- B. Preparation for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installing anchorages, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors, that are to be embedded in concrete as masonry construction. Coordinate delivery of such items to Project site.

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections accurately together to form tight, hairline joints.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing handrails and railing systems. Set handrails and railing systems accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.
 - 1. Do not weld, cut, or abrade surfaces of handrails and railing components that have been coated or finished after fabrication and are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of 1/4 inch in 12 feet (2 mm in 1 m).
 - 3. Align rails so that variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (2 mm in 1 m).

3.3 ANCHORING POSTS

- A. Anchor posts in concrete with pipe sleeves preset and anchored into concrete. After posts have been inserted into sleeves, solidly fill annular space between post and sleeve with the following anchoring material, mixed and placed to comply with anchoring material manufacturer's directions.
 - 1. Nonshrink, nonmetallic grout.
- B. Leave anchorage joint exposed, wipe off surplus anchoring material, and leave 1/8-inch (3-mm) buildup, sloped away from post.
- C. Coat post with asphalt paint to 1/2" above grade.

3.4 ATTACHING HANDRAILS TO WALLS

- A. Attach handrails to wall with wall brackets and end fittings. Provide bracket with 1-1/2-inch (38-mm) clearance from inside face of handrail to finished wall surface.
- B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- C. Secure wall brackets and wall return fittings to building construction as follows:
1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
 2. For concrete and solid masonry anchorage, use drilled-in expansion shield and either concealed hanger bolt or exposed lag bolt, as applicable.
 3. For hollow masonry anchorage, use toggle bolts with square heads.
 4. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed anchors using self-tapping screws of size and type required to support structural loads.

3.5 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material.

END OF SECTION 05 52 13

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 6: WOOD AND PLASTICS
Section 06 10 00: Rough Carpentry

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Fire-retardant rooftop equipment bases and support curbs.
 - 2. Fire-retardant wood grounds, nailers, and blocking (including plywood).
 - 3. Sheathing (Type X moisture resistant glass fiber surfaced).
 - 4. Fire-retardant blocking as required for Toilet and Miscellaneous Accessories.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 6 Section "Finish Carpentry" for nonstructural carpentry items exposed to view and not specified in another Section.

1.3 DEFINITIONS

- A. Rough carpentry includes carpentry work not specified as part of other Sections and generally not exposed, unless otherwise specified. All concealed wood blocking and plywood shall be fire-retardant-treated wood.

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract.
- B. Product data for the following products:
 - 1. Insulating sheathing.
 - 2. Metal framing anchors.
 - 3. Construction adhesives.
- C. Material certificates for dimensional lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use as well as design values approved by the Board of Review of American Lumber Standards Committee.
- D. Wood treatment data as follows including chemical treatment manufacturer's instructions for handling, storing, installation, and finishing of treated material:
 - 1. For each type of preservative treated wood product include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
 - 2. For water-borne treated products include statement that moisture content of treated

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- materials was reduced to levels indicated prior to shipment to project site.
3. For fire-retardant-treated wood products include certification by treating plant that treated material complies with specified standard and other requirements.
 4. Material test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of fire-retardant-treated wood products with requirements indicated.
 5. Warranty of chemical treatment manufacturer for each type of treatment.

1.5 QUALITY ASSURANCE

- A. Single-Source Responsibility for Fire Retardant Treated Wood: Obtain each type of fire-retardant-treated wood products from one source for both treatment and fire-retardant formulation.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Storage: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber as well as plywood and other panels; provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials.
 1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

PART 2 - PRODUCTS

2.1 LUMBER, GENERAL

- A. Lumber Standards: Furnish lumber manufactured to comply with PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.
- B. Inspection Agencies: Inspection agencies and the abbreviations used to reference them with lumber grades and species include the following:
 1. SPIB - Southern Pine Inspection Bureau.
 2. WWPA - Western Wood Products Association.
- C. Grade Stamps: Provide lumber with each piece factory-marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
- D. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.
 1. Provide dressed lumber, S4S, unless otherwise indicated.
 2. Provide seasoned lumber with 19 percent maximum moisture content at time of dressing and shipment for sizes 2 inches or less in nominal thickness, unless otherwise indicated.

2.2 MISCELLANEOUS LUMBER

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. General: Provide lumber for support or attachment of other construction including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.
- B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.
- C. Moisture content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.
- D. Grade: "Standard" grade light-framing-size lumber of any species or board-size lumber as required. "No. 3 Common" or "Standard" grade boards per WCLIB or WWPA rules or "No. 2 Boards" per SPIB rules.

2.3 CONSTRUCTION PANELS FOR BACKING

- A. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant-treated plywood panels with grade designation, APA C-D PLUGGED EXPOSURE 1, in thickness indicated, or, if not otherwise indicated, not less than 15/32 inch.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of AISI Type 304 stainless steel.
- B. Nails, Wire, Brads, and Staples: FS FF-N-105.
- C. Power Driven Fasteners: National Evaluation Report NER-272.
- D. Wood Screws: ANSI B18.6.1.
- E. Lag Bolts: ANSI B18.2.1.
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and where indicated, flat washers.

2.5 METAL FRAMING ANCHORS

- A. General: Provide metal framing anchors of type, size, metal, and finish indicated that comply with requirements specified including the following:
 - 1. Current Evaluation/Research Reports: Provide products for which model code evaluation/research reports exist that are acceptable to authorities having jurisdiction and that evidence compliance of metal framing anchors for application indicated with the building code in effect for this Project.
 - 2. Allowable Design Loads: Provide products for which manufacturer publishes allowable design loads that are determined from empirical data or by rational engineering analysis and that are demonstrated by comprehensive testing performed by a qualified independent

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

testing laboratory.

- B. Galvanized Steel Sheet: Steel sheet zinc-coated by hot-dip process on continuous lines prior to fabrication to comply with ASTM A 525 for Coating Designation G60 and with ASTM A 446, Grade A (structural quality); ASTM A 526 (commercial quality); or ASTM A 527 (lock-forming quality); as standard with manufacturer for type of anchor indicated.
 - 1. Use galvanized steel framing anchors for rough carpentry exposed to weather, in ground contact, or in area of high relative humidity, and where indicated.
- C. Painted Steel Sheet: ASTM A 366 (commercial quality) cold rolled steel sheet or ASTM A 570, Grade 33 (structural quality) hot-rolled steel sheet, as standard with manufacturer for type of anchor indicated, coated after fabrication with manufacturers standard, fast-curing, lead-free "universal primer" resistant to normal atmospheric corrosion.
 - 1. Use painted steel framing anchors for rough carpentry not exposed to weather, in ground contact, or in area of high relative humidity.

2.6 MISCELLANEOUS MATERIALS

- A. Sill Sealer Gaskets: Glass fiber resilient insulation fabricated in strip form for use as a sill sealer; 1-inch nominal thickness compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated; in rolls of 50 feet or 100 feet in length.
- B. Water Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbonate (IPBC) as its active ingredient.

2.7 PRESERVATIVE WOOD TREATMENT BY PRESSURE PROCESS

- A. General: Where lumber or plywood is indicated as preservative-treated wood or is specified herein to be treated, comply with applicable requirements of AWPA Standards C2 (Lumber) and C9 (Plywood). Mark each treated item with the AWPB or SPIB Quality Mark Requirements.
- B. Pressure-treat above-ground items with water-borne preservatives to a minimum retention of 0.25 pcf. For interior uses, after treatment, kiln-dry lumber and plywood to a maximum moisture content, respectively, of 19 percent and 15 percent. Treat indicated items and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - 3. Wood framing members less than 18 inches above grade.
 - 4. Wood floor plates installed over concrete slabs directly in contact with earth.
- C. Pressure-treat wood members in contact with the ground or fresh water with water-borne preservatives to a minimum retention of 0.40 pcf.
- D. Complete fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces to comply with AWPA M4. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

2.8 GYPSUM SHEATHING

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Gypsum Sheathing Board with Water Resistant Core: Gypsum sheathing board consisting of noncombustible gypsum core incorporating a water-resistant material, surfaced on face, back, and long edges with water-repellent paper; complying with ASTM C 79 and requirements indicated below:
1. Type: Regular (not Type X).
 2. Edge and End Configuration: Square.
 3. Thickness: 1/2 inch.
 4. Size: As indicated.
- B. Available Products: Subject to compliance with requirements, gypsum sheathing boards that may be incorporated in the Work include, but are not limited to, the following:
1. Gypsum Sheathing Board with Water-Resistant Core, Regular Type:
 - a. "Centex American Gypsum Sheathing," Centex American Gypsum Co.
 - b. "Gyproc Gypsum Sheathing," Domtar Gypsum Co.
 - c. "G-P Gypsum Sheathing", Georgia-Pacific Corp.
 - d. "Gold Bond Gypsum Sheathing," Gold Bond Building Products Div., National Gypsum Co.
 - e. "USG Gypsum Sheathing," United States Gypsum Co.
 2. Glass-Fiber-Surfaced Gypsum Sheathing Board, Regular Type:
 - a. "Dens-Glass Gold," Georgia-Pacific Corp.
 3. Glass-Fiber-Surfaced Gypsum Sheathing Board, Type X:
 - a. "Dens-Glass Gold Firestop," Georgia-Pacific Corp.
 4. Gypsum Sheathing Board with Water Resistant Core: Gypsum sheathing board consisting of noncombustible gypsum core incorporating a water-resistant material, surfaced on face, back, and long edges with water-repellent paper; complying with ASTM C 79 and requirements indicated below:
 1. Type: Fire Rated Type X
 2. Edge and End Configuration: Square.
 3. Thickness: 1/2 inch.
 4. Size: As indicated.

2.9 FIRE-RETARDANT TREATMENT BY PRESSURE PROCESS

- A. General: Where fire-retardant-treated wood is indicated, pressure impregnate lumber and plywood with fire-retardant chemicals to comply with AWPA C20 and C27, respectively, for treatment type indicated: identify "fire-retardant-treated wood" with appropriate classification marking of Underwriters Laboratories, Inc., U.S. Testing, Timber Products Inspection, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.
1. Current Evaluation/Research Reports: Provide fire-retardant-treated wood for which a

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

current model code evaluation/research report exists that is acceptable to authorities having jurisdiction and that evidence compliance of fire-retardant-treated wood for application indicated.

- B. Interior Type A: For interior locations use fire-retardant chemical formulation that produces treated lumber and plywood with the following properties under conditions present after insulation:
 - 1. No reduction takes place in bending strength, stiffness, and fastener holding capacities below values published by manufacturer of chemical formulation that are based on tests by a qualified independent testing laboratory of treated wood products identical to those indicated for this Project under elevated temperature and humidity conditions simulating installed conditions.
 - 2. No other form of degradation occurs due to acid hydrolysis or other causes related to manufacture and treatment.
 - 3. No Corrosion of metal fasteners results from their contact with treated wood.
- C. Exterior Type: Use for exterior locations and where indicated.
- D. Inspect each piece of treated lumber or plywood after drying and discard damaged or defective pieces.
- E. Available Products: Subject to compliance with requirements, fire-retardant-treated wood products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Interior Type A Fire-Retardant-Treated Wood:
 - a. "Dricon," Hickson Corporation.
 - b. "Pyro-Guard," Hoover Treated Wood Products.
 - c. "Flameproof LHC-HTT," Osmose Wood Preserving Co., Inc.
 - 2. Exterior Type Fire-Retardant-Treated Wood:
 - a. "Exterior Fire-X", Hoover Treated Wood Products.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Discard units of material with defects that impair quality of rough carpentry construction and that are too small to use in fabricating rough carpentry with minimum joints or optimum joint arrangement.
- B. Set rough carpentry to required levels and lines, with members plumb and true to line and cut and fitted.
- C. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.
- D. Securely attach rough carpentry work to substrate by anchoring and fastening as required.
- E. Countersink nail heads on exposed carpentry work and fill holes.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- F. Use common wire nails, unless otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.

3.2 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

- A. Install wood grounds, nailers, blocking, and sleepers where shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.
- B. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

END OF SECTION 06 10 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 6: WOODWORK
Section 06 40 23: Interior Architectural Woodwork

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section.

1.2 SUMMARY

A. This Section includes the following:

1. Wood cabinets (casework / millwork).
2. Cabinet tops (countertops).
3. Plywood shelving with solid nosings.
4. Stainless Steel Countertops
5. Running and Standing Trim
6. Decorative Panels, Wainscot, Courtroom Railings and Miscellaneous Trim.

B. Related Sections: The following sections contain requirements that relate to this section:

1. Division 6 Section "Rough Carpentry" for furring, blocking, and other carpentry work that is not exposed to view.
2. Division 8 Section "Flush Wood Doors" for doors specified by reference to architectural woodwork standards.
3. Division 9 Section "Painting" for final finishing of installed architectural woodwork.
4. Division -- "Stainless Steel Countertops"

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract.

B. Shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

C. Samples for verification purposes of the following:

1. Laminate clad panel products, 8-1/2 inches, by 11 inches for each type, color, pattern, and surface finish, with separate samples of unfaced panel product used for core.
2. Exposed cabinet hardware, one unit of each type and finish.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firm experienced in successfully producing architectural woodwork similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.

B. Single-Source Manufacturing and Installation Responsibility: Engage a qualified Manufacturer to assume undivided responsibility for woodwork specified in this section, including fabrication,

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

finishing, and installation.

- C. AWI Quality Standard: Comply with applicable requirements of "Architectural Woodwork Quality Standards" published by the Architectural Woodwork Institute (AWI) except as otherwise indicated.
- D. Hardware Coordination: Distribute copies of approved scheduled for cabinet hardware specified in Division 8 Section "Finish Hardware" to manufacturer of architectural woodwork; coordinate cabinet shop drawings and fabrication with hardware requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.
- B. Do not deliver woodwork until painting, wet work, grinding, and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in "Project Conditions."

1.6 PROJECT CONDITIONS

- A. Environmental Conditions: Obtain and comply with Woodwork Manufacturer's and Installer's coordinated advice for optimum temperature and humidity conditions for woodwork during its storage and installation. Do not install woodwork until these conditions have been attained and stabilized so that woodwork is within plus or minus 1.0 percent of optimum moisture content from date of installation through remainder of construction period.
- B. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before manufacturing woodwork; show recorded measurements on final shop drawings. Coordinate manufacturing schedule with construction progress to avoid delay of Work.

PART 2 - PRODUCTS

2.1 HIGH PRESSURE DECORATIVE LAMINATE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high pressure decorative laminates which may be incorporated in the work include but are not limited to the following:
 - 1. Formica Corp.
 - 2. Laminart.
 - 3. Micarta Div., Westinghouse Electric Corp.
 - 4. Nevamar Corp.
 - 5. Ralph Wilson Plastics Co.
 - 6. Sterling Engineered Products, Inc.

2.2 MATERIALS

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. General: Provide materials that comply with requirements of the AWI woodworking standard for each type of woodwork and quality grade indicated and, where the following products are part of woodwork, with requirements of the referenced product standards, that apply to product characteristics indicated:
1. High Pressure Laminate: NEMA LD 3.
 2. Softwood Plywood: PS 1.

2.3 FABRICATION, GENERAL

- A. Wood Moisture Content: Comply with requirements of referenced quality standard for moisture content of lumber in relation to relative humidity conditions existing during time of fabrication and in installation areas.
- B. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
1. Corners of cabinets and edges of solid wood (lumber) members less than 1 inch in nominal thickness: 1/16 inch.
 2. Edges of rails and similar members more than 1 inch in nominal thickness: 1/8 inch.
 3. All exposed edges of wood shelves, drawers, cabinets, etc., shall have 3/4" x 3/4" solid hard wood nosings.
- C. Complete fabrication, including assembly, finishing, and hardware application, before shipment to project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- D. Factory-cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges of cutouts with a water-resistant coating.

2.4 WOOD CABINETS (CASEWORK) FOR TRANSPARENT FINISH

- A. Quality Standard: Comply with AWI Section 400 and its Division 400A "Wood Cabinets."
- B. Grade: Custom.
- C. AWI Type of Cabinet Construction: Reveal overlay.
- D. Wood Species for Exposed Surfaces: Natural birch, plain sawn/sliced.
1. Matching of Veneer Leaves: Book match.
 2. Veneer Matching Within Panel Face: Running match.
- E. Wood Species for Semiexposed Surfaces: Match species and cut indicated for exposed surfaces.

2.5 CABINET HARDWARE AND ACCESSORY MATERIALS

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, as required.
- B. For concealed hardware provide manufacturer's standard finish that complies with product class requirements of ANSI/BHMA A156.9.

2.6 ARCHITECTURAL CABINET TOPS (COUNTERTOPS)

- A. Quality Standard: Comply with AWI Section 400 and its Division 400C.
- B. Type of Top: High pressure decorative laminate complying with the following:
 - 1. Grade: Custom.
 - 2. Laminate Cladding for Horizontal Surface: High pressure decorative laminate as follows:
 - a. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1) Provide selections made by Architect from manufacturer's full range of standard colors and finishes in the following categories:
 - a) Solid colors.
 - b. Grade: GP-50 (0.050-inch nominal thickness).
 - 3. Edge Treatment: Lumber edge for transparent finish matching wood species and cut on cabinet surfaces.
 - 4. Edge Treatment: As indicated.

2.7 FASTENERS AND ANCHORS

- A. Screws: Select material, type, size, and finish required for each use. Comply with FS FF-S-111 for applicable requirements.
- B. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.
- C. Anchors: Select material, type, size, and finish required by each substrate for secure anchorage. Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts and anchors, as required, to be set into concrete or masonry work for subsequent woodwork anchorage.

2.8 FACTORY FINISHING OF INTERIOR ARCHITECTURAL WOODWORK

- A. Quality Standard: Comply with AWI Section 1500 unless otherwise indicated.
- B. General: The entire finish of interior architectural woodwork is specified in this section, regardless

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

of whether factory applied or applied after installation.

1. Factory Finishing: The extent to which the final finish is applied to architectural woodwork at factory is General Contractor's option, except factory apply at least prime/base coat to the greatest extent possible before delivery.
- C. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces and similar preparations for finishing of architectural woodwork, as applicable to each unit of work.
- D. Transparent Finish for Open-Grain Woods: Comply with requirements indicated below for grade, finish system, staining, effect, and sheen, with sheen measured on 60 deg gloss meter per ASTM D 523.
1. Grade: Custom.
 2. AWI Finish System #5: Catalyzed polyurethane.
 3. Staining: Match approved sample for color.
 4. Effect: Open grain.
 5. Sheen: Semigloss bright rubbed effect 55-60 deg.
- E. Transparent Finish for Closed-Grain Woods: Comply with requirements indicated below for grade, finish system, staining, effect, and sheen.
1. Grade: Custom.
 2. AWI Finish System #5: Catalyzed polyurethane.
 3. Staining: Match approved sample for color.
 4. Effect: Closed grain.
 5. Sheen: Semigloss bright rubbed effect 55-60 deg.
- F. Plastic Laminate Cabinet fronts, faces, doors, drawers, tops and backsplashes where shown on drawings and specified herein.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installing.
- B. Deliver concrete inserts and similar anchoring devices to be built into substrates well in advance of time substrates are to be built.
- C. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

3.2 INSTALLATION

- A. Quality Standard: Install woodwork to comply with AWI Section 1700 for same grade specified in Part 2 of this section for type of woodwork involved.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 8'-0" for plumb and level (including tops) and with no variations in flushness of adjoining surfaces.
- C. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.
- D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fastener heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.
- E. Cabinets: Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated. Maintain veneer sequence matching (if any) of cabinets with transparent finish.
- F. Tops: Anchor securely to base units and other support systems as indicated.
- G. Complete the finishing work specified in this section to whatever extent not completed at shop or before installation of woodwork.

3.3 ADJUSTMENT AND CLEANING

- A. Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semi exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.4 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensures that woodwork is being without damage or deterioration at time of Substantial Completion.

END OF SECTION 06 40 23

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 7: THERMAL AND MOISTURE PROTECTION
Section 07 11 05: Miscellaneous Waterproofing

1 RELATED DOCUMENTS

- A Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section.

1.1 GENERAL:

- A. The work includes the furnishing and installation of dampproofing. All materials as specified herein shall be installed in accordance with manufacturer's written instructions.

1.2 MATERIALS AND INSTALLATION:

- A. The exterior face of all concrete and masonry in cavity of veneer walls shall have one(1) brushed on coat of emulsion - type dampproofing equal to W.R. Meadows Sealastic Type 2. Coating shall be applied at the rate of 30-35 sq.ft./gal. (1/16" thick). Concrete and masonry shall be thoroughly cleaned of all scale, loose mortar, rust, dirt, oil, grease, and other foreign matter before application of coating.
- B. Waterstops for construction joints shall be equal to Green Streak No. 778, 9" x 1/2" with 3/4" o.d. bulb. Lesser width may be used, with Architects approval, to meet varying conditions.

END OF SECTION 07 11 05

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 7 THERMAL AND MOISTURE PROTECTION
Section 07 13 00: Sheet Waterproofing

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

- A. This Section includes sheet membrane waterproofing systems.
- B. Types of sheet waterproofing specified in this Section include the following:
 - 1. Bituminous sheet waterproofing, premolded.
- C. Foundation drainage system is specified in a Division 2 Section.

1.3 SYSTEM PERFORMANCE

- A. General: Provide sheet waterproofing products, insulation protection board, and associated water stop, bulbs and other devices that have been produced and installed to establish and maintain continuous watertight seals.

1.4 SUBMITTALS

- A. General: Submit the following according to Conditions of Contract.
- B. Product data and general recommendations from waterproofing materials manufacturer for types of waterproofing required.
 - 1. Certification by waterproofing materials manufacturer that products supplied comply with local VOC regulations.
- C. Samples of sheet membrane waterproofing and auxiliary materials mounted on plywood, as requested by Architect.

1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Obtain primary waterproofing materials of each type required from a single manufacturer to the greatest extent possible. Provide secondary materials only as recommended by manufacturer of primary materials.
- B. Installer: A firm with not less than five waterproofing projects similar to requirements for this

MEDICAL, PSYCHIATRIC,
MINIMUM SECURITY HOLDING UNITS
ADDITIONS TO THE TUSCALOOSA COUNTY JAIL
TUSCALOOSA, ALABAMA

Project with satisfactory in-service performance and which is acceptable to primary waterproofing materials manufacturer.

- C. Preinstallation Conference: Prior to installing waterproofing and associated work, meet at Project site with Installer of each component of associated work, inspection and testing agency representatives (if any), and installers of work requiring coordination with waterproofing work. Review material selections and procedures to be followed in performing work. Notify Architect at least 48 hours before conducting meeting.

1.6 PROJECT CONDITIONS

- A. Substrate: Proceed with work after substrate construction, openings, and penetrating work have been completed and areas are free of standing or running water, ice, and frost. Verify that concrete is dry, smooth, and free from sharp or ragged out-angles, honeycombing, rock pockets, depressions, and projections.
- B. Weather: Proceed with waterproofing and associated work only when existing and forecasted weather conditions will permit work to be performed in accordance with manufacturers' recommendations and warranty requirements.

1.7 WARRANTY

- A. Warranty: Submit a written warranty executed by the manufacturer, agreeing to repair or replace sheet membrane waterproofing that fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- B. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the General Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 BITUMINOUS SHEET WATERPROOFING

- A. General: Premolded 7-ply membrane consisting of a plasmatic matrix encased in fortified bitumen and topped by a weather-coated, inert reinforcing ply. Below the core is a reinforcing carrier sheet to which is bonded a flexible polymeric surface of 62.5-mil thickness covered by a nonstick release paper. Water vapor transmission rating of 0.00 grains/(hr x sq. ft.) (ASTM E 96, Method B).
 - 1. MELNAR, W.R. Meadows, Inc. or equal

2.2 AUXILIARY MATERIALS

- A. Adhesives and Joint Tape: Provide types of adhesive compound and tapes recommended by waterproofing sheet manufacturer for bonding to substrate (if required), for waterproofing seams

MEDICAL, PSYCHIATRIC,
MINIMUM SECURITY HOLDING UNITS
ADDITIONS TO THE TUSCALOOSA COUNTY JAIL
TUSCALOOSA, ALABAMA

in membrane, and for waterproofing joints between membrane and flashings, adjoining surfaces, and projections through membrane.

- B. Primers: Provide type of concrete primer recommended by manufacturer of sheet waterproofing material for applications required.
- C. Flashing Materials: Except as otherwise indicated, provide types of flexible sheet material for flashing as recommended by waterproofing sheet manufacturer.
- D. Protection Board: Provide type of protection board recommended by waterproofing sheet manufacturer. Include adhesives recommended by manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. General: Comply with manufacturer's instructions for preparing surface.
- B. On concrete decks, immediately before placing waterproofing sheet, grind or abrasive-blast surface lightly to remove projections that might penetrate sheet and curing compounds that would interfere with fully bonded systems. Clean deck of loose material by brooming and vacuuming.
- C. On vertical foundation walls chip off projections where necessary to properly place and adhere waterproofing sheet.
- D. Apply primer to substrate surfaces at rate recommended by manufacturer of primary waterproofing materials. Prime only area that will be covered by waterproofing membrane in same working day. Reprime areas not covered by waterproofing membrane within 24 hours.

3.2 INSTALLATION

- A. Comply with manufacturer's instructions for handling and installing sheet waterproofing materials.
- B. Coordinate installing waterproofing materials with associated work to provide complete system complying with combined recommendations by manufacturers and installers involved in Work. Schedule installation to minimize exposure of sheet waterproofing materials.
- C. Seal projections through membrane and seal seams. Bond to vertical surfaces and also, where shown or recommended by manufacturer, bond to horizontal surfaces.
- D. Top Edge Seal: For vertical and sloped-wall membrane, finish in reglet (where provided); otherwise finish under flashing or under masonry in joint. Caulk exposed edges with mastic or sealant.
- E. Expansion Joints: Install joint filler with protruding rounded surface, as recommended by manufacturer.
 - 1. Apply continuous 8-inch-wide strip of membrane on joint, followed by membrane

MEDICAL, PSYCHIATRIC,
MINIMUM SECURITY HOLDING UNITS
ADDITIONS TO THE TUSCALOOSA COUNTY JAIL
TUSCALOOSA, ALABAMA

application.

- F. Coat exposed areas of sheet and flashing materials. Comply with sheet manufacturer's recommendations for applying and curing the coating.
- G. Protection Board: Install protection board over completed membrane, complying with manufacturer's recommendations for both waterproofing sheet and protection course materials.

3.3 FIELD QUALITY CONTROL

- A. In-Place Testing: Before completed membranes on horizontal surfaces are covered by protection course or other work, test for leaks with a 1-inch depth of water maintained over the high point for 24 hours. Repair any leaks observed; repeat test and repairs until no leaks remain.

3.4 CLEANING

- A. General: After completion, remove any masking materials and stains from exposed surfaces caused by waterproofing installation.

3.5 PROTECTION

- A. General: Protect completed membrane during installation of other materials or processes over membrane and throughout remainder of construction period. Do not allow traffic of any type on unprotected membrane.

END OF SECTION 07 1 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 7: THERMAL AND MOISTURE PROTECTION
Section 07 19 00: Water Repellents

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section.

1.2 SUMMARY

- A. This Section includes surface preparation and application of clear water repellent coating to the following vertical and nontraffic horizontal exposed surfaces:
 - 1. Exterior brick masonry units.
 - 2. Exterior concrete masonry units.
 - 3. Interior unfinished concrete masonry units.
 - 4. Precast Concrete Panels
 - 5. Exterior Synthetic Stone Units
 - 6. Exterior Fiber Reinforced Concrete Fascia Panels
- B. Related Sections: The following sections contain requirements that relate to this Section:
 - 1. Division 3 Sections for concrete work including floor sealers and curing agents, precast concrete, and concrete restoration and cleaning.
 - 2. Division 4 Section for concrete unit masonry, and cleaning.
 - 3. Division 7 Section "Joint Sealants" for joint fillers and sealants.
 - 4. Division 9 Section "Painting" for paints and coatings.

1.3 SUBMITTALS

- A. General: Submit the following according to the Conditions of Contract.
- B. Product data including manufacturer's specifications, surface preparation and application instructions, recommendations for water repellents for each surface specified, and protection and cleaning instructions. Include data substantiating that materials are recommended by manufacturer for applications indicated and comply with requirements.
- C. Samples: Submit 16-inch-square samples of each substrate indicated to receive water repellent with the specified repellent treatment applied to half of each sample.
- D. Certification by water repellent manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOC).
- E. Material test reports from qualified independent testing agency indicating and interpreting test results relative to compliance of water repellents with Performance Requirements specified in the "Quality Assurance" article.

1.4 QUALITY ASSURANCE

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Installer Qualifications: Engage an experienced Installer who employs only persons trained and approved by water repellent manufacturer for installation of manufacturer's products.
- B. Manufacturer Qualifications: Firm experienced in manufacturing products similar to those indicated for this Project and that has a record of successful in-service performance.
- C. Regulatory Requirements: Comply with applicable rules of the pollution-control regulatory agency having jurisdiction in the Project locale regarding volatile organic compounds (VOC) and use of hydrocarbon solvents.
- D. Project Mockup: Apply water repellent to mockup, either partial or full coverage as directed, before proceeding with installation. Comply with installation requirements of this Section.
- E. Performance Requirements: Indicate test results for water repellents on substrate simulating Project conditions, as close as possible. Use same materials and methods of application to be used on the Project.
 - 1. Absorption Tests: Comparison of treated and untreated specimens:
 - a. Brick: ASTM C 67.
 - b. Stone: ASTM C 97.
 - c. Concrete Masonry Units: ASTM C 140.
 - 2. Water Vapor Transmission: ASTM E 96. Comparison of treated and untreated specimens:
 - 3. Water Penetration and Leakage Through Masonry: ASTM E 514.
 - 4. Chloride Ion Intrusion: National Cooperative Highway Research Program (NCHRP) Report 244, Series II tests for percent reduction of water absorption and percent reduction in chloride content in concrete.

1.5 PROJECT CONDITIONS

- A. Weather and Substrate Conditions: Do not proceed with application of water repellent (except with written recommendation of manufacturer) under any of the following conditions:
 - 1. Ambient temperature is less than 40 deg F (4 deg C).
 - 2. Substrate surfaces have cured for less than one month.
 - 3. Rain or temperatures below 40 deg F (4 deg C) are predicted for a period of 24 hours.
 - 4. Earlier than 24 hours after surfaces became wet.
 - 5. Substrate is frozen, or surface temperature is less than 40 deg F (4 deg C).
 - 6. Windy condition such that repellent may be blown to vegetation or substrates not intended.

1.6 WARRANTY

- A. Warranty: Submit a written warranty, executed by the Applicator and water repellent manufacturer covering materials and labor, agreeing to repair or replace materials that fail to provide water repellency within the specified warranty period. This warranty shall be in addition to, and not a limitation of, other rights the Owner may have against the contractor under the contract documents.
 - 1. Warranty Period: 5 years from date of Substantial Completion.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
1. Silane, 40 Percent Solids:
 - a. Sil-Act ATS 42, Advanced Chemical Technologies.
 - b. Aridox 40, Anti Hydro Company, Inc.
 - c. Versaseal "S" 40, Applied Polymers of America, Inc.
 - d. Weather Worker S-40, Dayton Superior Corp.
 - e. Chem-Trete BSM 40, Huls America Inc.
 - f. Hydrozo Enviroseal 40, Hydrozo Inc.
 - g. Pentane 40, L & M Construction Chemicals, Inc.
 - h. Klereseal 940-S, Pecora Corporation.
 - i. Weather Seal H40, ProSoCo, Inc.
 - j. Penetrating Sealer 40, Sonneborn Building Products.
 - k. Stonite S19 40, Stonhard, Inc.
 - l. Barcade Silane 40 Percent, Tamms Industries.
 - m. Rainstopper 140, Textured Coatings of America, Inc.

2.2 WATER REPELLENTS

- A. Silane, 40 Percent Solids: Penetrating water repellent. A monomeric compound containing approximately 40 percent alkyltrialkoxysilanes with alcohol, mineral spirits, water, or other proprietary solvent carrier.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrate of substances that might interfere with penetration or performance of water repellents. Test for moisture content, according to repellent manufacturer's instructions to ensure that surface is sufficiently dry.
- B. Test for pH level, according to repellent manufacturer's instructions to ensure chemical bond to silicates minerals.
- C. Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass where there is the possibility of the water repellent being deposited on surfaces. Cover live plants and grass. Immediately clean water repellent from adjoining surfaces, complying with manufacturer's cleaning recommendations.
- D. Coordination with Sealants: Do not apply water repellent until the sealants for joints adjacent to surfaces receiving water repellent treatment have been installed and cured.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Water repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those used in the work.
- E. Test Application: Prior to performing water repellent work, including bulk purchase or delivery of products, prepare a small application in an unobtrusive location and in a manner acceptable to the Architect to demonstrate the final effect (visual, physical, and chemical) of planned installation. Proceed with work only after Architect accepts test application or as otherwise directed.
1. Revisions of planned installation, if any, and as requested by Architect, will be by change order where it constitutes a departure from requirements of contract documents at time of contracting.

3.2 INSTALLATION

- A. Apply a heavy-saturation spray coating of water repellent on surfaces indicated for treatment using low-pressure spray equipment. Comply with manufacturer's instructions and recommendations using airless spraying procedure unless otherwise indicated.
- B. Apply a second saturation spray coating, repeating first application. Comply with manufacturer's instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if printed recommendations are not applicable to Project conditions.
- C. Remove protective coverings from adjacent surfaces.

END OF SECTION 07 19 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 7: THERMAL AND MOISTURE PROTECTION
Section 07 21 00: Building Insulation

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Block/board cavity wall and masonry unit cell insulation.
 - 2. Safing insulation.
 - 3. Building insulation in batt form.
 - 4. Flexible blanket sound insulation.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 7 section indicated below for batt insulation.
 - a. "Standing Seam Retrofit System – Loc – Seam Panel."

1.3 DEFINITIONS

- A. Thermal Resistivity: Where the thermal resistivity of insulation products are designated by "R-values," they represent the reciprocal of thermal conductivity (k-values). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivities are expressed by the temperature difference in degrees F between the two exposed faces required to cause one BTU to flow through one square foot per hour at mean temperatures indicated.

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract.
- B. Product data for each type of insulation product specified.

1.5 QUALITY ASSURANCE

- A. Fire Performance Characteristics: Provide insulation materials identical to those whose indicated fire performance characteristics have been determined per the ASTM test method indicated below, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing and inspecting organization.
 - 1. Surface Burning Characteristic: ASTM E 84.
 - 2. Fire Resistance Ratings: ASTM E 119.
- B. Single-Source Responsibility for Insulation Products: Obtain each type of building insulation from a single source with resources to provide products of consistent quality in appearance and

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

physical properties without delaying progress of the Work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering insulation products that may be incorporated in the work include, but are not limited to, the following:

1. Extruded Polystyrene Board Insulation:
 - a. Amoco Foam Products Co.
 - b. DiversiFoam Products.
 - c. Dow: The Dow Chemical Company.
 - d. US Industries, Inc.
2. Manufacturers of Semi-Refractory Fiber Insulation:
 - a. Cafco Industries, Ltd.
 - b. Fibrex Inc.
 - c. USG: Thermafiber Div., USG Interiors, Inc.
3. Manufacturers of Glass Fiber Insulation:
 - a. CertainTeed Corp.
 - b. Knauf Fiber Glass GmbH.
 - c. Manville: Building Insulations Div., Manville Sales Corp.
 - d. Owens/Corning Fiberglas Corp.

2.2 INSULATING MATERIALS

- A. General: Provide insulating materials that comply with requirements and with referenced standards.
1. Preformed Units: Sizes to fit applications indicated, selected from manufacturer's standard thicknesses, widths, and lengths.
- B. Extruded Polystyrene Board Insulation: Rigid, cellular polystyrene thermal insulation with closed-cells and integral high-density skin, formed by the expansion of polystyrene base resin in an extrusion process to comply with ASTM C 578 for type indicated, with 5-year aged R-values of 5.4 and 5 at 40 and 75 deg F (4.4 and 23.9 deg C), respectively; and as follows:
1. Type IV, 1.6 pcf min., density, unless otherwise indicated.
 2. Surface Burning Characteristics: Maximum flame spread, and smoke developed values of 75 and 450, respectively.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- C. Faced Mineral Fiber Blanket/Batt Insulation: Thermal insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665 for Type III, Class A (blankets with reflective vapor-retarder membrane facing with flame spread of 25 or less); kraft vapor-retarder membrane on one face, in thickness as shown on drawings.
- D. Flexible blanket sound insulation for all interior metal stud walls or above ceilings shall be equal to Owens-Corning Fiberglass Noise Barrier Batts 3 ½" thick or as indicated on drawings and in width to fit snug between studs. Install in interior walls between studs from floor to deck above in accordance with manufacturer's written instructions.

2.3 SAFING INSULATION AND ACCESSORIES

- A. Semi-Refractory Fiber Board Safing Insulation: Semi-rigid boards designed for use as a fire stop at openings between edge of slab and exterior wall panels, produced by combining semi-refractory mineral fiber manufactured from slab with thermosetting resin binders to comply with ASTM C 612, Class 1 and 2; nominal density of 4.0 pcf; passing ASTM E 136 for combustion characteristics; R-value of 4.0 at 75 deg F (23.9 deg C).
- B. Calking Compound: Material approved by manufacturer of safing insulation for sealing joint between foil backing of safing insulation and edge of concrete floor slab against penetration of smoke.
- C. Safing Clips: Galvanized steel safing clips approved by manufacturer of safing insulation for holding safing insulation in place.

2.4 BUILDING INSULATION IN BATT FORM

- A. Faced Mineral Fiber Blanket/batt insulation: Thermal insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665 for Type III, Class A (blankets with reflective vapor-polyethylene vapor-retarder membrane of one face, and as follows:
 - 1. Mineral Fiber Type: Fibers manufactured from glass or slag.
 - 2. Surface Burning Characteristics: Maximum flame spread, and smoke developed values of 24 and 50, respectively.
 - 3. Flanged Units: Provide blankets/batts fabricated with facing incorporating 4-inch-wide flanges along their edges for attachment to framing membranes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions with Installer present, for compliance with requirements of the Sections in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation of insulation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulations or vapor retarders, including removal of projections that might puncture vapor retarders.

3.3 INSTALLATION, GENERAL

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Comply with insulation manufacturer's instructions applicable to products and application indicated. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with installation of insulation.
- B. Extend insulation full thickness as indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections that interfere with placement.
- C. Apply a single layer of insulation of required thickness, unless otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Apply insulation units to substrate by method indicated, complying with manufacturer's recommendations. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Seal joints between closed-cell (nonbreathing) insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
- C. Set vapor retarder faced units with vapor retarder to warm side of construction, except as otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.
 - 1. Tape joints and ruptures in vapor retarder and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
- D. Set reflective, foil-faced units accurately with not less than 0.75-inch air space in front of foil as indicated.
- E. Stuff glass fiber loose fill insulation into miscellaneous voids and cavity spaces where shown. Compact to approximately 40 percent of normal maximum volume (to a density of approximately 2.5 pcf). Make certain to fill voids at window jambs.

3.5 INSTALLATION OF SAFING INSULATION

- A. Install safing insulation to fill gap between edge of concrete floor slab and back of exterior spandrel panels on safing clips spaced as needed to support insulation but not further apart than 24 inches o.c. Cut safing insulation wider than gap to be filled to ensure compression fit and seal joint between insulation and edge of slab with calking approved by safing insulation manufacturer for this purpose. Leave no voids in completed installation.

3.6 INSTALLATION OF MASONRY UNIT CELL INSULATION AND FILL

- A. Inserts shall be installed in the cores of blocks at the Block Producer's Plant so that blocks with inserts already installed are delivered to the job site. Inserts shall be properly installed in accordance with the manufacturer's specifications to allow blocks to be handled without danger of insert dislodgment.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3.7 PROTECTION

- A. General: Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 7: THERMAL AND MOISTURE PROTECTION
Section 07 25 00: Vapor Barrier / Building Wrap

PART 1 – GENERAL - Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section.

1.1 SECTION INCLUDES

- A. Weather barrier membrane for installation at new exterior sheathing.
- B. Seam Tape
- C. Flashing
- D. Fasteners

1.2 REFERENCES

- A. ASTM International
 - 1. ASTM C920; Standard Specification for Elastomeric Joint Sealants
 - 2. ASTM C1193; Standard Guide for Use of Joint Sealants
 - 3. ASTM D882; Test Method for Tensile Properties of Thin Plastic Sheeting
 - 4. ASTM D1117; Standard Guide for Evaluating Non-woven Fabrics
 - 5. ASTM E84; Test Method for Surface Burning Characteristics of Building Materials
 - 6. ASTM E96; Test Method for Water Vapor Transmission of Materials
 - 7. ASTM E1677; Specification for Air Retarder Material or System for Framed Building Walls
 - 8. ASTM E2178; Test Method for Air Permeance of Building Materials
 - 9. ASTM E2357; Standard Test Method for Determining Air Leakage of Air Barrier Assemblies
- B. AATCC – American Association of Textile Chemists and Colorists
 - 1. Test Method 127 Water Resistance: Hydrostatic Pressure Test
- C. TAPPI
 - 1. Test Method T-410; Grams of Paper and Paperboard (Weight per Unit Area)
 - 2. Test Method T-460; Air Resistance (Gurley Hill Method)

1.3 SUBMITTALS

- A. Refer to Section 01300 Submittals.
- B. Product Data: Submit manufacturer current technical literature for each component.
- C. Samples: Weather Barrier Membrane, minimum 8-1/2 inches by 11 inches.
- D. Quality Assurance Submittals
 - 1. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with indicated requirements.
 - 2. Manufacturer Instructions: Provide manufacturer's written installation instructions.
 - 3. Manufacturer's Field Service Reports: Provide site reports from authorized field service representative, indicating observation of weather barrier assembly installation.
- E. Closeout Submittals

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Refer to Project Closeout Section.
2. Weather Barrier Warranty: Manufacturer's executed warranty form with authorized signatures and endorsements indicating date of Substantial Completion.

1.4 QUALITY ASSURANCE

A. Qualifications

1. Installer shall have experience with installation of commercial weather barrier assemblies under similar conditions.
2. Installation shall be in accordance with weather barrier manufacturer's installation guidelines and recommendations.
3. Source Limitations: Provide commercial weather barrier and accessory materials produced by single manufacturer.

B. Mock-up

1. Install mock-up using approved weather barrier assembly including fasteners, flashing, tape and related accessories per manufacturer's current printed instructions and recommendations.
 - a. Mock-up size: 10 feet by 10 feet.
 - b. Mock-up Substrate: Match wall assembly construction, including window opening.
 - c. Mock-up may remain as part of the work.
2. Contact manufacturer's designated representative prior to weather barrier assembly installation, to perform required mock-up visual inspection and analysis as required for warranty.

C. Pre-installation Meeting

1. Refer to Division 1 Section.
2. Hold a pre-installation conference, two weeks prior to start of weather barrier installation. Attendees shall include Contractor, Architect, Engineer, Installer, Owner's Representative, and Weather Barrier Manufacturer's Designated Representative.
3. Review all related project requirements and submittals, status of substrate work and preparation, areas of potential conflict and interface, availability of weather barrier assembly materials and components, installer's training requirements, equipment, facilities and scaffolding, and coordinate methods, procedures and sequencing requirements for full and proper installation, integration and protection.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver weather barrier materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.
- B. Store weather barrier materials as recommended by weather barrier manufacturer.

1.6 SCHEDULING

- A. Review requirements for sequencing of installation of weather barrier assembly with installation of windows, doors, louvers and flashings to provide a weather-tight barrier assembly.
- B. Schedule installation of weather barrier materials and exterior cladding within nine months of weather barrier assembly installation.

1.7 WARRANTY

- A. Refer to Section 01740: Warranties and Bonds.
- B. Special Warranty
 - 1. Special weather-barrier manufacturer's warranty for weather barrier for a period of ten (10) years from date of purchase.
 - 2. Pre-installation meetings and jobsite observations by weather barrier manufacturer for warranty are required.
 - 3. Warranty Areas: Everywhere the barrier is used including but not limited to behind insulated metal panels on sheathing, at windows, etc.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. DuPont [basis of design] (1-800-44-TYVEK <http://www.construction.tyvek.com>) or approved equal.

2.2 MATERIALS

- A. Basis of Design: spunbonded polyolefin, non-woven, non-perforated, weather barrier is based upon DuPont™ Tyvek® CommercialWrap® and related assembly components or approved equal.
- B. Performance Characteristics:
 - 1. Air Penetration: 0.001 cfm/ft² at 75 Pa, when tested in accordance with ASTM E2178. Type I per ASTM E1677. 0.04 cfm/ft² at 75 Pa, when tested in accordance with ASTM E2357
 - 2. Water Vapor Transmission: 28 perms, when tested in accordance with ASTM E96, Method B.
 - 3. Water Penetration Resistance: 280 cm when tested in accordance with AATCC Test Method 127.
 - 4. Basis Weight: 2.7 oz/yd², when tested in accordance with TAPPI Test Method T-410.
 - 5. Air Resistance: Air infiltration at >1500 seconds, when tested in accordance with TAPPI Test Method T-460.
 - 6. Tensile Strength: 38/35 lbs/in., when tested in accordance with ASTM D882, Method A.
 - 7. Tear Resistance: 12/10 lbs., when tested in accordance with ASTM D1117.
 - 8. Surface Burning Characteristics: Class A, when tested in accordance with ASTM E 84. Flame Spread: 10, Smoke Developed: 10.

2.3 ACCESSORIES

- A. Seam Tape: 3 inch wide, DuPont™ Tyvek® Tape for commercial applications.
- B. Fasteners:
 - 1. DuPont™ Tyvek® Wrap Cap Screws, as distributed by DuPont: 1-5/8 inch rust resistant screw with 2-inch diameter plastic cap or manufacturer approved 1-1/4" or 2" metal gasketed washer
 - 2. Masonry tap-con fasteners with Tyvek® Wrap Caps as distributed by DuPont: 2-inch diameter plastic cap fasteners.
- C. Sealants:
 - 1. Provide sealants that comply with ASTM C920, elastomeric polymer sealant to maintain

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- watertight conditions.
2. Products:
 - a. DuPont™ Commercial Sealant
 - b. Sealants recommended by the weather barrier manufacturer.
- D. Adhesives:
1. Provide adhesive recommended by weather barrier manufacturer.
 2. Products:
 - a. Liquid Nails® LN-109
 - b. Denso Butyl Liquid
 - c. 3M High Strength 90
 - d. SIA 655
 - e. Adhesives recommend by the weather barrier manufacturer.
- E. Primers:
1. Provide flashing manufacturer recommended primer to assist in adhesion between substrate and flashing.
 2. Products:
 - a. 3M High Strength 90
 - b. Denso Butyl Spray
 - c. SIA 655
 - d. Permagrip 105
 - e. ITW TACC Sta' Put SPH
 - f. Primers recommended by the flashing manufacturer
- F. Flashing
1. DuPont™ FlexWrap™, as distributed by DuPont: flexible membrane flashing materials for window openings and penetrations.
 2. DuPont™ StraightFlash™, as distributed by DuPont: straight flashing membrane materials for flashing windows and doors and sealing penetrations such as masonry ties, etc.
 3. DuPont™ StraightFlash™ VF, as distributed by DuPont: dual-sided straight flashing membrane materials for brick mold and non-flanged windows and doors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify substrate and surface conditions are in accordance with weather barrier manufacturer recommended tolerances prior to installation of weather barrier and accessories.

3.2 INSTALLATION – WEATHER BARRIER

- A. Install weather barrier over exterior face of exterior wall substrate in accordance with manufacturer recommendations.
- B. Install weather barrier prior to installation of windows and doors.
- C. Start weather barrier installation at a building corner, leaving 6-12 inches of weather barrier extended beyond corner to overlap.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- D. Install weather barrier in a horizontal manner starting at the lower portion of the wall surface with subsequent layers installed in a shingling manner to overlap lower layers. Maintain weather barrier plumb and level.
- E. Sill Plate Interface: Extend lower edge of weather barrier over sill plate interface 3-6 inches. Secure to foundation with elastomeric sealant as recommended by weather barrier manufacturer.
- F. Window and Door Openings: Extend weather barrier completely over openings.
- G. Overlap weather barrier
 - 1. Exterior corners: minimum 12 inches.
 - 2. Seams: minimum 6 inches.
- H. Weather Barrier Attachment:
 - 1. Attach weather barrier to studs through exterior sheathing. Secure using weather barrier manufacturer recommended fasteners, space 12 -18 inches vertically on center along stud line, and 24-inch on center, maximum horizontally.
 - 2. Attach weather barrier to masonry. Secure using weather barrier manufacturer recommended fasteners, spaced 12-18 inches vertically on center and 24 inches maximum horizontally. Weather barrier may be temporarily attached to masonry using recommended adhesive, placed in vertical strips spaced 24 inches on center, when coordinated on the project site.
- I. Apply 4 inch by 7-inch piece of DuPont™ StraightFlash™ or weather barrier manufacturer approved alternate to weather barrier membrane prior to the installation cladding anchors.

3.3 SEAMING

- A. Seal seams of weather barrier with seam tape at all vertical and horizontal overlapping seams.
- B. Seal any tears or cuts as recommended by weather barrier manufacturer.

3.4 OPENING PREPARATION (for use with non-flanged windows – all cladding types)

- A. Flush cut weather barrier at edge of sheathing around full perimeter of opening.
- B. Cut a head flap at 45-degree angle in the weather barrier at window head to expose 8 inches of sheathing. Temporarily secure weather barrier flap away from sheathing with tape.

3.5 FLASHING (for use with non-flanged windows – all cladding types)

- A. Cut 9-inch-wide DuPont™ FlexWrap™ a minimum of 12 inches longer than width of sill rough opening. Apply primer as required by manufacturer.
- B. Cover horizontal sill by aligning DuPont™ FlexWrap™ edge with inside edge of sill. Adhere to rough opening across sill and up jambs a minimum of 6 inches. Secure flashing tightly into corners by working in along the sill before adhering up the jambs.
- C. Fan DuPont™ FlexWrap™ at bottom corners onto face of wall. Firmly press in place. Mechanically fasten fanned edges.
- D. Apply 9-inch-wide strips of DuPont™ StraightFlash™ at jambs. Align flashing with interior edge of jamb framing. Start DuPont™ StraightFlash™ at head of opening and lap sill flashing down to the sill.
- E. Spray-apply primer to top 6 inches of jambs and exposed sheathing.
- F. Install DuPont™ FlexWrap™ DuPont™ at opening head using same installation procedures used at sill. Overlap jamb flashing a minimum of 2 inches.
- G. Coordinate flashing with window installation.

- H. On exterior, install backer-rod in joint between window frame and flashed rough framing. Apply sealant at jambs and head, leaving sill unsealed. Apply sealants in accordance with sealant manufacturer's instructions and ASTM C 1193.
- I. Position weather barrier head flap across head flashing. Adhere using 4-inch-wide DuPont™ StraightFlash™ over the 45-degree seams.
- J. Tape top of window in accordance with manufacturer recommendations.
- K. On interior, install backer rod in joint between frame of window and flashed rough framing. Apply sealant around entire window to create air seal. Apply sealant in accordance with sealant manufacturer's instructions and ASTM C 1193.

3.6 OPENING PREPARATION (for use with flanged windows)

- A. Cut weather barrier in an “I-cut” pattern. A modified I-cut is also acceptable.
 - 1. Cut weather barrier horizontally along the bottom and top of the window opening.
 - 2. From the top center of the window opening, cut weather barrier vertically down to the sill..
 - 3. Fold side and bottom weather barrier flaps into window opening and fasten.
- B. Cut a head flap at 45-degree angle in the weather barrier at window head to expose 8 inches of sheathing. Temporarily secure weather barrier flap away from sheathing with tape.

3.7 FLASHING (for use with flanged windows)

- A. Cut 9-inch-wide DuPont™ FlexWrap™ a minimum of 12 inches longer than width of sill rough opening.
- B. Cover horizontal sill by aligning DuPont™ FlexWrap™ edge with inside edge of sill. Adhere to rough opening across sill and up jambs a minimum of 6 inches. Secure flashing tightly into corners by working in along the sill before adhering up the jambs.
- C. Fan DuPont™ FlexWrap™ at bottom corners onto face of wall. Firmly press in place. Mechanically fasten fanned edges.
- D. On exterior, apply continuous bead of sealant to wall or backside of window mounting flange across jambs and head. Do not apply sealant across sill.
- E. Install window according to manufacturer's instructions.
- F. Apply 4-inch-wide strips of DuPont™ StraightFlash™ at jambs overlapping entire mounting flange. Extend jamb flashing 1-inch above top of rough opening and below bottom edge of sill flashing.
- G. Apply 4-inch-wide strip of DuPont™ StraightFlash™ as head flashing overlapping the mounting flange. Head flashing should extend beyond outside edges of both jamb flashings.
- H. Position weather barrier head flap across head flashing. Adhere using 4-inch-wide DuPont™ StraightFlash™ over the 45-degree seams.
- I. Tape head flap in accordance with manufacturer recommendations.
- J. On interior, install backer rod in joint between frame of window and flashed rough framing. Apply sealant around entire window to create air seal. Apply sealant in accordance with sealant manufacturer's instructions and ASTM C 1193.

3.8 FIELD QUALITY CONTROL

- A. Notify manufacturer's designated representative to obtain [required] periodic observations of weather barrier assembly installation.

3.9 PROTECTION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

A. Protect installed weather barrier from damage.

END OF SECTION 07 25 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 07 00 00: THERMAL AND MOISTURE PROTECTION
Section 07 42 13.19: Insulated Metal Wall Panels

PART 1 GENERAL

Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section.

1.1 SECTION INCLUDES

- A. Composite Metal Wall Panels and Soffits where indicated.
- B. Metal trim, accessories, fasteners, and sealants.

1.2 RELATED SECTIONS

- A. Cold-Formed Metal Framing.
- B. Flashing, Sheet Metal and Prefinished Metal Trim and Accessories: Counter flashing.
- C. Joint Sealants: Caulking and sealants.

1.3 REFERENCES

- A. AAMA 501 - Standard test method for metal curtain walls for water penetration using dynamic pressure.
- B. AAMA 610.1 - Voluntary Guide Specification for Cleaning and Maintenance of Painted Aluminum Extrusions and Curtain Wall Panels.
- C. AISC - American Institute of Steel Construction, Code of Standard Practice for Steel Buildings and Bridges.
- D. ASTM C 236 - Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box.
- E. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
- F. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- G. ASTM E 108 - Standard Test Methods for Fire Tests of Roof Coverings.
- H. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
- I. UL 723 - Underwriters Laboratory, Test for Surface Burning Characteristics of Building Materials.
- J. FM 4471 - Factory Mutual Class 1 Panel Roofs.
- K. FM 4880 - Factory Mutual Class 1 Fire Rating of Insulated Wall or Wall and Roof/Ceiling Panels, Interior Finish Materials or Coatings, and Exterior Wall Systems.
- L. USDA - United States Department of Agriculture Finish Approval Standards.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- M. UL 580 - Standard For Tests For Uplift Resistance of Roof Assemblies
- N. ASTM E 283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- O. ASTM E 1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.

1.4 DESIGN / PERFORMANCE REQUIREMENTS

- A. Structural: Structural designs shall have been determined from independent tests conducted in accordance with ASTM E 72, "Chamber Method."
- B. Thermal Properties: Panels shall provide a "U" value corrected to 15 mph wind outside and still air inside, when determined from tests conducted in accordance with ASTM C 236.
- C. Air Leakage: Panel joints shall be tested for air leakage in accordance with ASTM E 283/AAMA 501. Leakage rate for wall panels shall not exceed 0.01 CFM/SF at a pressure difference of 40 psf.
- D. Water Penetration: Panel joints shall be tested for water penetration in accordance with ASTM E 331/AAMA501. There shall be no water penetration for wall panels at a pressure difference of 50 psf.
- E. Fire Tests: Panels shall be qualified by laboratory scale fire tests for acceptance by building code and insurance authorities. Evidence of fire performance shall include the following:
 - 1. Underwriters Laboratories, Inc. classified and labeled for "Surface Burning Characteristics of Building Materials," UL 723 and ASTM E 84.
 - a. Core Materials (5 inches): Flame Spread 20, Smoke Developed 400.
 - b. Finished Wall Panels: 2 inch to 5 inch (51 mm to 127 mm) thick ESP Wall Panels: Flame Spread 15, Smoke Developed 250- 450.
 - 2. Factory Mutual listed and labeled for "Surface Burning Characteristics of Building Materials", ASTM E 84. Core Materials (5 inches):
 - a. Flame Spread 25, Smoke Developed 180.
 - 3. Factory Mutual Approved and labeled for "Class 1 Insulated Wall & Roof/Ceiling Panels", Factory Mutual Standard 4880, to 30 feet (maximum) high, 5 inch (127 mm) maximum thickness.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings: Show profile, panel thickness, gauge of interior and exterior sheets, location and type of fasteners, gauges, shape, and method of attachment of all trim, location and type of sealants, accessories, and finishes.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, minimum size 6

inches (150 mm) square, representing actual product, color, and patterns.

- F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- G. Manufacturer's warranties as specified.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Minimum of 10 years documented experience in the production of factory foamed-in-place metal skinned insulated panels with projects of similar size and complexity.
 - 2. Manufacturer certified by the American Institute of Steel Construction (AISC) verifying it has sustained audits to confirm it has a continuing quality control program.
- B. Installer Qualifications: Minimum of 5 years documented experience installing metal skinned insulated panels on projects of similar size and complexity.
- C. Mock-Up: Provide a mock-up using specified products and manufacturer approved installation methods for evaluation of installation techniques and workmanship.
 - 1. Mockup shall include typical panel to panel and panel to adjacent surfaces with both horizontal and vertical joint conditions.
 - 2. Locate where directed and approve by the Architect.
 - 3. Maintain mock-up during construction for workmanship comparison.
 - 4. Do not proceed with remaining work until workmanship and color, is approved by Architect.
 - 5. Approved mock-up may remain as part of finished work.
- D. Pre-installation Meetings: Conduct a pre-installation meeting one week prior to commencing work of this section, to verify project requirements, co-ordinate with installers of other work, establish condition and completeness of building substrate, and review manufacturer's installation instructions and manufacturer's warranty requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging, with identification labels intact, until ready for installation.
- B. Handle and store products according to manufacturer's recommendations published in technical materials. Leave products wrapped or otherwise protected and under clean and dry storage conditions until required for installation.
- C. Store to protect corners and to prevent damage or marring of finish. Store under cover on building site in a manner to prevent damage and water accumulation.
- D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.8 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.9 WARRANTY

- A. Submit, for Owner's acceptance, Manufacturer's standard warranty document executed by

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

authorized company official covering the following:

1. Paint finish against cracking, chalking, blistering, peeling, flaking and chipping for a period of 20 years.

1.10 COORDINATION

- A. Coordinate Work with other operations and installation of related materials to avoid damage to installed panels and adjacent work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Insulated Panel Systems (basis of design); Centria Architectural Systems; Metl Span, Butler Manufacturing Company.
- B. Requests for substitutions will be considered in accordance with provisions of the General Conditions.

2.2 COMPOSITE PANELS

- A. Insulated Composite Wall Panels: ESP Insulated Wall Panels, factory foamed in place with a striated exterior face and offset shiplap side joints that allow both panel faces to be mechanically attached to supports.

Basis of Design : Metl Span CF Santa Fe Wall Panel or approved equivalent.

1. Panel Width:
 - a. 30 inches
2. Panel Thickness: ESP-200, 2 inches (51 mm), U Factor of 0.063.
3. Exterior Face: Aluminum zinc alloy coated steel with a minimum AZ50 coating class, conforming to ASTM A 792 or zinc coated steel with a G90 minimum coating class, conforming to ASTM A 653. Provided with a stucco embossed surface texture with a striated surface pattern.
 - a. Exterior Face Thickness:
 - 1) 24-gauge steel.
 - b. Finish:
 - 1) Fluoropolymer Enamel: Signature 300 - Premium 70 percent resin Kynar 500/Hylar 5000 paint system.
 - c. Color shall be as selected by the Architect and shall be from the manufacturer's standard and premium selections.
4. Interior Face: Aluminum zinc alloy coated steel with a minimum AZ50 coating class, conforming to ASTM A 792 or zinc coated steel with a G60 minimum coating class, conforming to ASTM A 653. Provided with a stucco embossed surface texture with a mesa pattern.
 - a. Interior Face Thickness:
 - 1) 26-gauge steel.
 - b. Finish:
 - 1) USDA Approved Finish: USDA Approved White Paint finish.
5. Insulating Foam Core: Foamed-in-place rigid modified isocyanurate using an HCFC blowing agent with the following physical properties:
 - a. Density: 2.0 pcf nominal.
 - b. Compressive strength: 23 psi.
 - c. Tensile strength: 39 psi

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- d. Shear strength: 26 psi.
 - e. Closed cell: 93 percent.
 - f. Cold aging: 1 percent volume decrease after 7 days at minus 20 degrees F (6.6 degrees C).
 - g. Heat aging: 3 percent volume increase after 28 days at 200 degrees F (93 degrees C).
 - h. Humid aging: 4 percent volume increase after 28 days at 158 degrees F (70 degrees C) and 100 percent R.H.
- B. Trim and Flashing: Formed sheet metal that is equal in thickness and finished to match the panel faces.
 - C. Panel Clips: 14-gauge galvanized steel concealed in the panel joint.
 - D. Exposed Fasteners: Stainless steel, stainless steel clad or cast zinc-aluminum alloy painted to match adjacent colors. All aluminum rivets shall be mill finish and unpainted.
 - E. Sealants:
 - 1. Field applied vapor barrier sealant in the panel joints shall be a butyl-based material that is non-skinning, non-drying, resealable with a service temperature range of minus 60 degrees F to 250 degrees F (15.5 degrees C to 221 degrees C).
 - 2. Field applied weather sealant shall be a silicone-based material with excellent adhesion and cohesion properties with a service temperature range of minus 60 degrees F to 300 degrees F (15.5 degrees C to 204 degrees C).

2.3 FABRICATION

- A. Fabricate panels and supports as indicated on the Drawings and as recommended by panel manufacturer.
 - 1. Make panel lines, breaks, curves, and angles sharp and true.
 - 2. Keep plane surfaces free from warp or buckle.
 - 3. Keep panel surfaces free of scratches or marks caused during fabrication.
 - 4. Cover exposed surfaces with pressure-sensitive heavy protection paper or apply strippable plastic coating, before shipping to job site.
- B. Take field measurements prior to commencement of shop fabrication.
 - 1. Field fabrication is allowed to ensure proper fit but keep field fabrication to minimum with majority of fabrication being done under controlled shop conditions.
 - 2. Where final panel dimensions cannot be established by field measurement before commencement of panel manufacturing, make allowance for field adjustments and thermal movement as recommended by panel manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Verify, when applicable, the alignment of structural steel before installation of panels conforms to the tolerances of AISC Code of Standard Practice, Section 7, including the supplement controlling Section 7.11.3, adjustable items.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Erect panels in accordance with reviewed shop drawings; anchor panels securely in accordance with reviewed shop drawings to allow for necessary thermal movement and structural support.
- C. Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- D. Panels shall be cut in the field for bevels and openings using manufacturer's recommendations and procedures.
- E. Anchor panels securely per engineering recommendations and in accordance with approved shop drawings to allow for necessary thermal movement and structural support.
- F. Sealants shall be installed without skips or voids to insure weathertightness and integrity of the vapor barrier system.
- G. Do not install component parts that are observed to be defective, including warped, bowed, dented, abraded and broken members.
- H. Do not cut, trim, weld or braze component parts during erection in manner that would damage finish, decrease strength, or result in visual imperfection or failure in performance. Return component parts that require alteration to shop for refabrication, if possible, or for replacement with new parts.
- I. Separate dissimilar metals and use gasketed fasteners, isolation shim, or isolation tape where needed to eliminate possibility of corrosive or electrolytic action between metals.

3.4 ERECTION TOLERANCES

- A. Maximum deviation from vertical and horizontal alignment of erected panels: 1/8 inch (3 mm) in 28 feet (8.53 m), non-accumulative.

3.5 ADJUSTING AND CLEANING

- A. Clean installed products in accordance with AAMA 610.1 and manufacturer's instructions before owner's acceptance.
- B. Remove masking film (if used) as soon as possible after installation.
- C. Remove temporary coverings in accordance with the manufacturer's instructions. Repair or replace damaged installed products.
- D. Remove from project site and legally dispose of construction debris associated with this work.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- E. Remove all debris and metal filings from the panel and trim surfaces at the end of each work period to prevent damage to the panels and possible rust staining.

3.6 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Final Acceptance.

END OF SECTION 07 42 13.19

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 7: THERMAL AND MOISTURE PROTECTION
Section 07 50 00: Standing Seam Retrofit Roofing Systems - LOC-Seam Panel

PART I - GENERAL

Drawings and any general provisions of the Contract for each Prime Contract, including General and Supplementary Conditions and specific requirements apply to this Section.

1.1 DESCRIPTION

- A. Provide all materials, labor, equipment and services, and perform all operations in connection with the furnishing and installing of roofing complete, in accordance with the drawings and specifications, and including, but not limited to, the following:

Note: No prior approval has been given for the use of a Light Gauge Metal Truss Systems in lieu of specified Retrofit Roof Framing Systems. Contractor please note the requirement for coordination drawings for all systems below the roof and the retrofit drawings for all systems below the roof and the retrofit roof framing. The coordination for all of these systems would preclude the use of trusses in this application. Light Gauge Trusses are therefore not approved.

1. A pre-formed and pre-finished metal roofing system, complete with retrofit framing systems, roof insulation, wall panels, soffit panels and soffit insulation.
2. Include perimeter flashing, trim, ridge and gable closures and flashing as applicable, fasteners, supplementary furring and supports and sealants required for complete roofing system.
3. Insulation as specified.
4. Roof Curbs
5. Roof Jacks
6. Workmanship
7. Inspection of Surfaces
8. Protection
9. Delivery, Samples and Shop Drawings
10. Guarantee and Warranty

1.2 Quality Assurance

- A. Manufacturer's Qualifications: The roof system manufacturer shall meet and provide written certification stating:

1. The manufacturer has been regularly engaged in the fabrication of metal standing seam roof systems for at least ten (10) years. A brief list of similar projects shall be submitted with the shop drawings.
2. The manufacturer is a member of the Metal Building Manufacturer's Association (MBMA).
3. The manufacturer is currently certified by the American Institute of Steel Construction (AISC) for category MB.
4. The manufacturer maintains a certified installer program for its products and maintains an up-to-date authorized roofing contractor list.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

5. The manufacturer has a written warranty covering durability, color and weathertightness of its roof system. Sample warranties shall be provided with the bid proposal.

B. Roofers Qualifications

1. Installation of the Loc-Seam metal roofing panel and roof related accessories shall be performed by roofers certified/preferred & authorized by the manufacturer as trained and qualified to erect the manufacturer's product.

C. Design Criteria

1. The following standards and criteria shall be used where covered by this specification:
 - a. Manual of Steel Construction, American Institute of Steel Construction - 8th Edition;
 - b. Cold Formed Steel Design Manual, American Iron and Steel Institute 0 1986 Edition.
 - c. Low Rise Metal Building Systems Manual, American Iron and Steel Institute -1986 Edition.
 - d. Change Building Code as required - Southern Standard Building Code - 1988 Edition.
 - e. Test for Wind Uplift Resistance of Roof Assemblies (1980) Underwriters Laboratories, Inc.
2. Design Loads
 - a. Design loads shall be developed using the procedures contained in "Design Practices and Design Practices" commentary in the MBMA publication, Low Rise Metal Building Systems Manual. The following data shall be used in developing design loads in addition to dead loads:
 - b. Vertical Live Loads: roof system shall be designed for a 20 PSF live load and as required by 1997 Standard Building Code.
 - c. Wind Loads: Basic wind speed of 80 miles per hour and as required by 1997 Standard Building Code.
 - d. Other superimposed dynamic and/or static loads such as exhaust fans and air conditioning equipment, shall be considered as part of the design requirements and combined with the normal design (live and wind) loads.
 - e. Combination of normal load and auxiliary loads for design purposes shall be as prescribed and recommended in the Southern Standard Building Code - 1997 Edition.
 - f. Seismic Loading Criteria:
 1. Seismic Hazard Exposure Group (1997 Standard Building Code) Group II
 2. Acceleration Coefficient .10
 3. Peak Acceleration Coefficient .10
 4. Site Coefficient 1.00
3. Framing and structural members shall be cold formed and designed in accordance with Cold Formed Steel Design Manual, AISI – 1986 and in full compliance with Division 5 Section 05400.
4. Roof and wall panels shall be designed in accordance with Cold Formed Steel Design Manual, AISI -1986.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1.3 Submittals:

A. Submittal Drawings

1. Submit shop drawings, clearly indicating scope of spacing and anchorage for attachment to structure, roof panels, insulation and ventilation, typical flashing details and typical accessory details.
2. Submit manufacturer's specification on all sealants.
3. Submit applicable sample warranties of products with bid proposals.
4. After awarding of contract, structural analysis of the retrofit subframing system shall be submitted with manufacturer's structural design engineer seal attached.
5. Submit for approval descriptive data on all material to be provided. Data shall be sufficient to indicate conformance to specified requirements.
6. Submit manufacturer's recommended installation method showing all requirements for retrofit framing and panel installation, sealant application and substructural connections.
7. Submit manufacturer's suggested material handling and material protection requirements.
8. Submittal drawings and structural analysis shall be sealed and signed by a professional engineer, registered in the state where roof will be installed.

1.4 Warranty

A. Roof and Wall Panels

1. Durability of the metallic coated and unpainted roof panels due to rupture, structural failure or perforation shall be warranted for a period of twenty (20) years by the manufacturer.

B. Weathertightness: The entire installation shall be guaranteed weathertight for a minimum of twenty (20) years. Provide written warranty, signed by metal roofing manufacturer and his authorized installed agreeing to replace/repair defective materials and workmanship during the warranty period.

PART II - PRODUCTS

2.1 STANDING SEAM ROOF SYSTEM:

A. Loc-Seam Panel - products shall be equal to or exceed the quality level of American Buildings Company's Loc-Seam Panel roof system. Other manufacturers are acceptable subject to compliance with specified requirements.

1. Deviations in appearance from the quality standard manufacturer's panel must be approved by the owner before acceptance.
2. Changes in framing or variations in loading to the existing structure caused by alternate roof systems shall be subject to review and all costs for any modifications shall be the responsibility of the general contractor.

B. System Description - The roof system is a concealed fastener interlocking standing seam system with faced batt insulation between support and panel.

1. Roof panels shall be standing seam interlocking design and secured to the supports with a concealed structural fastening system.
2. The concealed attachment system shall eliminate all through penetration of the exposed roofing surface into structural supports and allow the roof covering to move independently of any differential thermal movement by the framing system.
3. The panel to structural clip shall be designed to provide +/- one inch of thermal movement.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

It shall incorporate a self centered feature to assure one inch of movement in both directions.

4. The standing seam shall have integral male and female interlocking ribs with a factory applied, non-hardening sealant, and the seams shall be continuously locked or crimped together by mechanical means during installation.
5. Roof panels shall be fastened to the support framing members with a concealed clip or backing device of steel having a protective metallic coating. Through penetration of the roofing surface by exposed fasteners shall occur only for non-structural connection at panel termination and roof perimeter flashing location.
6. Panel termination and perimeter flashing (attached to roof panels) shall be sealed with sealants recommended by the manufacturer.
7. Required closures shall be metal. Non-metal closures shall not be acceptable.
8. Batt insulation shall have a density of 0.6 PCF and shall be R-30. Fiberglass insulation facing shall be laminated on one side with SMP-10. Provide one inch thick thermal blocks/thermal spacers at all deck supports.
9. Soffit panels shall be smooth interlocking seam.

C. Materials

1. Loc-Seam Panel - Standing seam roof panel shall have a configuration consisting of 2 inch high vertical rib spaced on 12 inch or 16 inch centers. The panel shall have flush horizontal and vertical surfaces to facilitate sealing at terminations. Panel configurations which create voids requiring supple metal closure devices shall not be considered acceptable. Panels shall be joined at the sidelap with an interlocking seam mechanically locked by a seaming machine after installation. The female panel seam shall have a factory applied sealant.
2. The panels shall be 24 gauge (minimum) steel, complying with ASTM A 526 with G90 coating complying with ASTM A 525.
 - a. Finishes General: Apply coatings either before or after forming and fabricating panels, as required by coating process and as required for maximum coating performance capability. Protect coating either by application of strippable film or by packing plastic film or other suitable material between panels in a manner to properly protect the finish. Furnish air-drying spray finish in matching color for touch-up.
 - (1) Color: As selected by the Architect from the manufacturer's standard colors.
 - b. Fluoropolymer Coating: Manufacturer's standard two-coat, thermo-cured, full-strength 70 percent "Kynar 500" coating consisting of a primer and a minimum 0.75-mil dry film thickness with a total minimum dry film thickness of 0.9 mil and 30 percent reflective gloss when tested in accordance with ASTM D 523.
 - (1) Durability: Provide coating that has been field tested under normal range of weathering conditions for minimum of 20 years without significant peel, blister, flake, chip, crack or check in finish; without chalking in excess of No. 8 in accordance with ASTM D 659; and without fading in excess of 5 NBS units.
3. Exposed roof fasteners shall be cadmium or zinc plated carbon steel with a molded nylon head and a 9/16" O.D. aluminum and bonded EPDM washer. Screw head to match color or roofing sheets. Plastic caps shall not be used. Self-tapping screws shall be #12 x 1-1/4. Self-drilling screws shall be #12 x 1/14.
4. Panel clip fasteners shall be cadmium plated carbon steel #12 x 1-1/4 self-drilling screws with hex washer head.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

5. Loc-Seam Panel - Panel clips for the standing seam panels shall be die formed 24 gauge aluminum coated steel. The clip base shall be 18 gauge galvanized steel.
6. Loc-Seam Panel - Required closures shall be metal. Non-metal closures shall not be acceptable.
7. Sidelap sealant shall be a factory applied butyl base mastic. Its composition shall be 85% to 90% solids by weight. Service temperature range shall be -60 degrees F to +225 degrees F.
8. Eave and ridge closure sealant shall be a 3/4" x 3/16" tape mastic. The mastic shall be a non-staining, non-corrosive, non-shrinking, non-oxidizing, non-toxic and non-volatile. Composition shall be 99% minimum solids with a butyl base meeting performance standards in Federal Specification TT-C-1796A, Type II, Class B. Service temperature shall be -60 degrees F to +212 degrees F.
9. Panel endlaps shall be sealed with a precut tape pad. The material shall be non-staining, non-corrosive, non-toxic, and non-volatile. Composition shall be 100% solid ethylene propylene copolymer tape meeting performance standards in Federal Specification TT-C-1796A, Type II, Class B. Service temperature shall be -60 degrees F to +212 degrees F.
10. Flashing laps shall be sealed with white or bronze pigmented urethane caulk. All caulk shall meet the performance standards in Federal Specification TT-S-0023OC, Type II, Class A.
11. Trim items and flat sheets for on site fabrication not required to have a Galvalume finish shall be 26 gauge minimum aluminum coated steel, Type II, conforming to the requirements of ASTM A463. Minimum yield stress shall be 50,000 PSI.
12. Wall trim, metal panel lap flashing, edge trims, rake trim and all exposed components shall have a finish to match adjacent or adjoining panels. Materials shall be 26 gauge minimum galvanized steel, coating designation G-90, conforming to the requirements of ASTM A446 Grade D. Minimum yield stress shall be 50,000 PSI.

2.2 Roof Accessories

- A. Roof Jacks - Openings 8" in diameter or smaller may be flashed and sealed to the roof panel by jacks.
 1. Material shall be an EPDM material with an aluminum sealing ring base.
 2. Jacks are acceptable providing attachment in flat of panel and no standing seam rib has been altered. If rib must be cut, a curb must be used.
 3. Installation of roof jacks must comply with manufacturer's instructions.
- B. Roof Curbs
 1. The roof curb units shall be fabricated to the specifications of the roofing manufacturer, thus assuring its compatibility with the roof construction's framing and covering.
 2. Roof curbs shall be of size and design to accommodate the various projecting elements to be retained. The contractor is responsible for verification of the various sizes, configurations, and requirements. It is expected that the contractor use the existing conditions, surfaces, and elements as a source material for these requirements.
 3. The roof curb shall be of size and design required for fan, vent or air conditioning equipment. It shall support the specific ventilating device in a nominally horizontal position above the weather surface of the roof and adequately deflect storm drainage around its periphery.
 4. All sealants, closures and fasteners, etc. shall be included for proper installation and performance. Roof subframing and/or headers between purlins shall be provided for additional rigidity and support of the curb and its ventilating device.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

5. Roof vent curb and supporting framing shall provide for expected expansion and contraction of roof panels.
- C. Ventilation - The space between new roof and attic floor shall not be ventilated.
- D. Materials and Construction
1. Metal roof curb shall be provided with a horizontal flanged top projecting a minimum of 8" above the weather surface plane. Curb design shall incorporate a built-in water deflector on the upslope side to prevent ponding and direct water around the curb. The base shall fit the roof slope and shall be compatible with the roofing panels to which it is flashed and/or sealed and fastened. Curb design shall utilize separate cap cells to allow positioning flexibility with roof ribs.
 2. The curb shall be fabricated of 18 gauge galvalume material prefinished to match roofing panel color. Shell and base plate assembly shall be fully mitered and welded. All exposed welds shall be cleaned and coated with the manufacturers standard zinc rich or aluminum based primer. Curbs longer than three feet shall have internal angle reinforcement designed by the manufacturer. Curbs called for on the drawings to be insulated shall have one and one-half inch thick three pound density fiberglass board insulation at curbs and base.
 3. Miscellaneous materials:
 - a. Sealing compounds shall be as specified and supplied by the roofing manufacturer.
 - b. Closures and fasteners shall conform to the roofing manufacturer's standards compatible with the roof covering furnished.
 - c. Provide flexible preformed "Deck Tight" units at pipes 10" in diameter and smaller; at larger than 10" diameter, provide curbs as described above.
- E. Installation - Shall conform to the roofing manufacturer's details and instructions shown on the assembly drawings together with accepted trade practices.

2.3 Roof Covering Support Members

- A. The roof covering support members shall be 16 gauge (minimum) shop primed steel conforming to the requirements of ASTM A525 with a minimum yield stress of 50,000 psi. Bracing shall be accomplished with 24 gauge galvanized steel strapping coating designation G-90, conforming to the requirements of ASTM A446 Grade D. Minimum yield stress shall be 50,000 psi.
- B. The configuration and spacing of supports shall be the roofing manufacturer's standard and shall be supported by a structural analysis.
 1. Spacing of supports other than standard must be reflected in structural calculations. Calculations shall be in accordance with the 1980 AISI Specification of the design of cold formed steel structural members.
- C. Deflection of roof covering support members shall not exceed L/180 of its span when supporting the design vertical live and applicable collateral loads and supported on spacings required on this project.
- D. The support members shall be designed to transfer roof dead and live loads as well as wind uplift loads directly to existing steel joist roof framing.

PART III - EXECUTION

3.1 ATTIC FLOOR SURFACE CONDITIONS

- A. Inspection
 1. Inspect installed work of other trades and verify that such work is complete to a point where

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

this work may commence.

2. Verify that installation may be made in accordance with approved shop drawings and manufacturer's instructions.

B. Discrepancies

1. In the event of a discrepancy, notify the Architect.
2. Do not proceed with installation until discrepancies have been resolved.

3.2 Installation

A. Install all components within this section where indicated on the shop drawings, anchoring all components firmly in place in complete accordance with the project drawings, approved shop drawings, and the manufacturer's recommendations.

1. Install all materials in strict accordance with the manufacturer's instructions, best trade practices and in a manner to provide a completely watertight installation.
2. Provide fastenings, expansion joints, cleats and all other required accessories for a complete installation as required. This manufacturer and subcontractor is responsible for design of all anchorage to Precast hollow core members to ensure specified wind load and uplift criteria is met.
3. All work will be performed by Preferred/Certified contractor and capable of supplying a 20 year labor and materials and weathertight results.
4. Make suitable provisions to allow for free expansion and contraction of all work without causing leaks or rupture. All work shall be securely fastened and where necessary for strength and/or stiffness, provide suitable reinforcement.
5. Water shall be prevented from entering the building during the work. This shall involve keeping penetrations sealed, planning the work to reroof sections and sealing new to old or other precautionary and effective safeguards.

END OF SECTION 07 50 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 7: THERMAL AND MOISTURE PROTECTION
Section 07 60 00: Flashing and Sheet Metal

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Metal counter flashing and base flashing.
 - 2. Metal wall flashing and expansion joints.
 - 3. Gutters and downspout leaders (rain drainage).
 - 4. Miscellaneous sheet metal accessories.
 - 5. Laminated and composition flashing.
- B. Integral masonry flashings are specified as masonry work in sections of Division 4.
- C. Roof accessory units of premanufactured, set-on type are specified in Division 7 Section "Roof Accessories."

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract.
- B. Product data, Flashing, Sheet Metal, and Accessories: Manufacturer's technical product data, installation instructions and general recommendations for each specified sheet material and fabricated product.
- C. Samples of the following flashing, sheet metal, and accessory items:
 - 1. 8-inch-square samples of specified sheet materials to be exposed as finished surfaces.
 - 2. 12-inch-long samples of factory-fabricated products exposed as finished work. Provide complete with specified factory finish.
- D. Shop drawings showing layout, profiles, methods of joining, and anchorages details, including major counterflashings, trim/fascia units, gutters, downspouts, scuppers, and expansion joint systems. Provide layouts at 1/4-inch scale and details at 3-inch scale.

1.4 PROJECT CONDITIONS

- A. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

PART 2 - PRODUCTS

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2.1 SHEET METAL FLASHING AND TRIM MATERIALS

- A. Zinc-Coated Steel: Commercial quality with 0.20 percent copper, ASTM A 526 except ASTM A 527 for lock-forming, G90 hot-dip galvanized, mill phosphatized where indicated for painting; 0.0359-inch thick (20 gage) except as otherwise indicated.
- B. Sheet Aluminum: ASTM B 209, alloy 3003, temper H14, finished with Galvalume (55% aluminum 45% zinc alloy) applied by continuous hot dip method (Triple spot minimum 0.55 ounce per square foot per ASTM A-792, 0.032-inch thick (20 gage) except as otherwise indicated. Use for gutters, downspouts, leader heads and scuppers.
- C. Where shown on drawings the reglet and flashing system shall be equal to Fry Springlok Type ST - stucco. Install per manufacturers recommendations.

2.15 FLUSH JOINT ALUMINUM COLUMN COVER

- A. PAC-1000F, by Perterson Aluminum Corporation, Basis of Design or approved equivalent.
- B. 0.125 Aluminum , round, size as indicated on drawings. Color to be selected by Architect from Manufacturer's full range of color options.

2.2 LAMINATED COMPOSITION SHEET FLASHING

- A. Copper/Paper Flashing: 3-oz. copper sheet laminated between 2 sheets of bituminous impregnated creped Kraft paper or saturated fabric.
- B. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Afco Products, Inc.; "Cop-A-Bond Duplex."
 - 2. Phoenix Building Products, Inc.; "Duplex Cop-R Flash."
 - 3. York Manufacturing, Inc.; "Cop-R-Tex Duplex."
- C. Miscellaneous Materials and Accessories:
- D. Solder: For use with steel or copper, provide 50 - 50 tin/lead solder (ASTM B 32), with rosin flux.
- E. Fasteners: Same metal as flashing/sheet metal or other non- corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.
- F. Bituminous Coating: SSPC - Paint 12, solvent-type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.
- G. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, non- drying, nonmigrating sealant.
- H. Elastomeric Sealant: Generic type recommended by manufacturer of metal and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 7 Section "Joint Sealers."
- I. Epoxy Seam Sealer: 2-part noncorrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior nonmoving joints including riveted joints.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- J. Adhesives: Type recommended by flashing sheet manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet.
- K. Paper Slip Sheet: 5-lb. rosin-sized building paper.
- L. Polyethylene Underlayment: Minimum 6-mil carbonated polyethylene film resistant to decay when tested in accordance with ASTM E 154.
- M. Reglets: Metal or plastic units of type and profile indicated, compatible with flashing indicated, noncorrosive.
- N. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage required for performance.
- O. Gutter and Conductor-Head Guards: 20-gage bronze or nonmagnetic stainless steel mesh or fabricated units, with selvaged edges and noncorrosive fasteners. Select materials for compatibility with gutters and downspouts.
- P. Elastic Flashing Filler: Closed-cell polyethylene or other soft closed-cell material recommended by elastic flashing manufacturer as filler under flashing loops to ensure movement with minimum stress on flashing sheet.
- Q. Roofing Cement: ASTM D 2822, asphaltic.

2.3 FABRICATED UNITS

- A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.
- B. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. For metal other than aluminum, tin edges to be seamed, form seams, and solder. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.
- C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in work cannot be used or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- D. Sealant Joints: Where movable, nonexpansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.
- E. Separations: Provide for separation of metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

separation as recommended by manufacturer/fabricator.

- F. Aluminum Extrusion Units: Fabricate extruded aluminum running units with formed or extruded aluminum joint covers for installation behind main members where possible. Fabricate mitered and welded corner units.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

- A. General: Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations and with SMACNA "Architectural Sheet Metal Manual." Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.
- B. Underlayment: Where stainless steel or aluminum is to be installed directly on cementitious or wood substrates, install a slip sheet of red rosin paper and a course of polyethylene underlayment.
- C. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.
- D. Install reglets to receive counterflashing in manner and by methods indicated. Where shown in concrete, furnish reglets to trades of concrete work for installation as work of Division 3 sections. Where shown in masonry, furnish reglets to trades of masonry work, for installation as work of Division 4 sections.
- E. Install counterflashing in reglets, either by snap-in seal arrangement or by welding in place for anchorage and filling reglet with mastic or elastomeric sealant, as indicated and depending on degree of sealant exposure.
- F. Install elastic flashing in accordance with manufacturer's recommendations. Where required, provide for movement at joints by forming loops or bellows in width of flashing. Locate cover or filler strips at joints to facilitate complete drainage of water from flashing. Seam adjacent flashing sheets with adhesive, seal and anchor edges in accordance with manufacturer's recommendations.
- G. Nail flanges of expansion joint units to curb nailers, at maximum spacing of 6 inches o.c. Fabricate seams at joints between units with minimum 3-inch overlap, to form a continuous, waterproof system.
- H. Install continuous gutter guards on gutters, arranged as hinged units to swing open for cleaning gutters. Install "beehive"-type strainer-guard at conductor heads, removable for cleaning downspouts.

3.2 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.
- B. Protection: Advise General Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

deterioration other than natural weathering at time of Substantial Completion.

END OF SECTION 07 60 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 7: THERMAL AND MOISTURE PROTECTION
Section 07 71 00: Roof Specialties and Accessories

1.1 GENERAL:

A. RELATED DOCUMENTS:

1. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section.

B. DESCRIPTION OF WORK:

1. Types of units specified in this section include the following:

Roof hatches
Prefabricated curb and equipment support units in color to match roofing materials.

C. QUALITY ASSURANCE:

1. Heat/Smoke Vent Compliance Labels: Provide units which have been tested, listed and labeled as follows:

Construction/Operation: UL-Labeled
Fire Resistance of Lids: UL Class "A"

2. Standards: Comply with SMACNA "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap-flashing to coordinate with type of roofing indicated. Comply with "NRCA Roofing and Waterproofing Manual" details for installation of units. NOTE: All roofing curb components will match the color of the roofing panels on which they are mounted.

2.1 PRODUCTS:

A. GENERAL PRODUCT REQUIREMENTS:

1. Provide manufacturers' standard units, modified as necessary to comply with requirements. Shop fabricate each unit to greatest extent possible.

B. MATERIALS GENERAL:

1. Zinc-Coated Steel: Commercial quality with 0.20 percent copper, ASTM A 535, G90 hot-dip galvanized, mill phosphatized.
2. Aluminum Sheet: ASTM B 209, alloy 3003, temper as required for forming and performance; AA-C22A41 clear anodized finish, except mill finish prepared for painting where required for field painting.
3. Extruded Aluminum: Manufacturer's standard extrusions of sizes and general profiles indicated, alloy 6063-T52, 0.078" minimum thickness for primary framing and curb members legs, 0.062" for secondary legs; AA-C22A41 clear anodized

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

finish exposed members, except as otherwise indicated.

4. Insulation: Manufacturer's standard rigid or semi-rigid board of glass fiber of thickness required.
5. Wood Nailers: Softwood lumber, pressure treated fire retardant with water-borne preservatives for above-ground use, complying with AWPB LP-2; not less than 1-1/2" thick.
6. Fasteners: Same metal as metals beings fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by manufacturer. Match finish of exposed fasteners with finish of material being fastened.

Where removal of exterior exposed fasteners affords access to building, provide nonremovable fastener heads.

7. Gaskets: Tubular or fingered design of neoprene or polyvinyl chloride, or block design of sponge neoprene.
8. Bituminous Coating: FS TT-C-494A or SSPC-Paint 12, solvent type bituminous mastic, nominally free of sulfur, compounded for 15 mil dry film thickness per coating.
9. Mastic Sealant: Polyisobutylene; non hardening, nonskinning, nondrying, nonmigrating sealant.
10. Elastomeric Sealant: Generic type recommended by unit manufacturer, which is compatible with joint surfaces; comply with FS TT-S-00227E, TT-S-00230C, or TT-S-001543A.
11. Roofing Cement: AST D 2822, asphaltic.
12. All units shall be prefinished to match roofing panel color selected.

C. PREFABRICATED ROOF HATCHES:

1. General: Fabricate units of sizes required single-leaf type unless otherwise indicated, for 40 lbs. per sq. ft. external loading and 20 lbs. per sq. ft. internal loading pressure. Frame with 12" high integral-curb double-wall construction with 1-1/2" insulation, cant stripes and cap flashing (roofing counter-flashing), with welded or sealed mechanical corner joints. Provide double-wall construction cover (lid) construction with 1" insulation core. Equip units with complete hardware set including hold-open devices, interior padlock hasps, and both interior and exterior latch handles. Provide gasketing. Fabricate units of following materials.

Materials: 14 ga. Powder Coated steel sheets. Color to match Roofing Panels

D. PREFABRICATED CURBS/EQUIPMENT SUPPORTS:

1. Comply with loading strength requirements as required where units support other work. Coordinate dimensions with rough-in sheets or shop drawings of equipment

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

to be supported. Fabricate of structural quality sheet steel (ASTM A 570, Grade as required) which has been prepared for painting and factory-primed and painted with 2-mil thickness of baked-on synthetic enamel, after fabrication.

Fabricate with welded or sealed mechanical corner joints. Provide complete with cant strips and base profile coordinated with roof insulation thickness. Provide preservative-treated wood nailers at tops of curbs, coordinate with thickness of insulation and roof flashing as indicated, tapered as necessary to compensate for roof deck slopes of 1/4" per ft. and less.

Except as other wise indicated or required for strength, fabricate units of minimum 14-gage (0.0747") metal, and to minimum height of 12".

3.1 EXECUTION:

A. INSTALLATION:

1. General: Comply with manufacturer's instructions and recommendations. Coordinate with installation of roof deck and other substrates to receive accessory units, and vapor barriers, roof insulation, roofing and flashing; as required to ensure that each element of the work performs properly, and that combined elements are waterproof and weathertight. Anchor units securely to supporting structural substrates, adequate to withstand lateral and thermal stresses as well as inward and outward loading pressures.

Except as otherwise indicated install roof accessory items in accordance with construction details of "NRCA Roofing and Waterproofing Manual".

2. Isolation: Where metal surfaces of units are to be installed in contact with noncompatible metal or corrosive substrates, including wood, apply bituminous coating on concealed metal surfaces, or provide other permanent separation.
3. Flange Seals: Except as otherwise indicated, set flanges of accessory units in a thick bed of roofing cement, to form a seal.
4. Cap Flashing: Where cap flashing is required as component of accessory, install to provide adequate waterproof overlap with roofing or roof flashing (as counter-flashing). Seal with thick bead of mastic sealant, except where overlap is indicated to be left open for ventilation.
5. Operational Units: Test operate units with operable components. Clean and lubricate joints and hardware. Adjust for proper operation.

B. CLEANING AND PROTECTION:

1. Clean exposed metal and plastic surfaces in accordance with manufacturer's instructions. Touch up damaged metal coatings.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

END OF SECTION 07 71 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 7: THERMAL AND MOISTURE PROTECTION
Section 07 71 13: Sheet Metal Coping

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Prefinished Aluminum copings as detailed.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 7 Section "Flashing and Sheet Metal" for the following Work (if indicated):
 - a. Metal flashing and counter flashing.
 - b. Scuppers, gutters, and downspouts.
 - c. Miscellaneous sheet metal accessories.
 - d. Elastic, laminated, and composition flashing.
 - 2. Sheet metal and flashings not part of coping system included in this Section are specified in another Division 7 Section.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract.
- B. Product data including manufacturer's technical data, installation instructions and general recommendations for each product specified. Include data substantiating that materials and performance comply with requirements.
- C. Shop drawings indicating layout, joining, profiles, accessories, anchorages, flashing connections, and relationship to supporting structure and to adjoining roof and wall construction.
- D. Samples for verification purposes of each type of exposed finish required, prepared on samples of size indicated below and of same thickness and material indicated for final unit of Work. Where finishes involve normal color and texture variations, include sample sets showing full range of variations expected. Provide samples of not less than the following sizes:
 - 1. Coping: 8 inches long.

1.4 QUALITY ASSURANCE

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Industry Standards: Provide products which comply with applicable requirements of SMACNA "Architectural Sheet Metal Manual," except as otherwise indicated.

1.5 JOB CONDITIONS

- A. Coordinate work of this Section with adjoining work for proper sequencing of each installation to ensure best possible weather resistance and protection of materials and finishes against damage.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Sheet: Alloy and temper recommended by manufacturer for use intended and as required for proper application of finish indicated but with not less than the strength and durability properties specified in ASTM B 209 for 5005-H15.

2.2 MISCELLANEOUS ITEMS

- A. Exposed Fasteners: Stainless steel, non-magnetic, of type and size standard with manufacturer for product and application indicated. Match finish of exposed heads with material being fastened.
- B. Concealed Fasteners: Same metal as item fastened or other noncorrosive metal as recommended by manufacturer.
- C. Mastic Sealant: Polyisobutylene; non-hardening, nonskinning, nondrying, nonmigrating sealant.
- D. Foam Rubber Seal: Manufacturer's standard foam.
- E. Adhesives: Type recommended by manufacturer for substrate and project conditions, and formulated to withstand minimum 60 psf uplift force.

2.3 ALUMINUM COPING

- A. Interlocking Multi-Part Coping System: Manufacturer's standard system consisting of coping formed from aluminum sheet to profile and of thickness indicated, minimum 24 gage (nominal 0.0276-inch-thick), zinc-coated steel anchor plate or cleat located at coping joint, and formed aluminum gutter chair or gutter/splice plate or compression pad/gutter; with prefabricated inside and outside corners, miters welded before finishing; without exposed fasteners.
 - 1. Thickness of Coping: 0.050 inch.
 - 2. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
 - a. Type AP Standard Coping; Architectural Products Co.
 - b. Rapid-Loc Coping; Atas Aluminum Corp.
 - c. Splice-Lock Coping Cover System; Cheney Flashing Co.
 - d. Permasnap Coping; W. P. Hickman Co.
 - e. Neo-Lock Coping; Merchant and Evans Industries, Inc.
 - f. Snap-Lok Coping; MM Systems Corp.
 - g. Pac-Loc Coping; Petersen Aluminum Corp.

2.4 FABRICATION

- A. General: Provide items designed and fabricated to fit applications indicated and to perform SHEET METAL COPING

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

optimally with respect to weather resistance, water tightness, durability, strength, and uniform appearance.

- B. Expansion Provisions: Fabricate running lengths to allow controlled expansion not only for movement of metal components in relationship to one another but also to adjoining dissimilar materials, including flashing and roofing membrane materials, in a manner sufficient to prevent water leakage, deformation or damage.

2.5 ALUMINUM FINISHES

- A. General: Comply with AMP 501 "Finishes for Aluminum" and AMP 505 "Applied Coatings" for finish designations and application recommendations, except as otherwise indicated. For components which are assembled or welded in factory, apply finish after fabrication is completed.
- B. Fluoropolymer Coating: Manufacturer's standard two-coat, thermo-cured, full strength 70 percent "Kynar 500" coating consisting of a primer and a minimum 0.75-mil dry film thickness with a total minimum dry film thickness 0.9 mil and 30 percent reflective gloss when tested in accordance with ASTM D523.
 - 1. Durability: Provide coating that has been field tested under normal range of weathering conditions for minimum of 20 years without significant peel, blister flake, chip, crack, or check in finish; without caulking in excess of No. 8 in accordance with ATSM D 659; and without fading in excess of 5 NBS units.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions and recommendations. Coordinate with installation of roof deck and other substrates to receive work of this Section, with vapor retarders, roof insulation, roofing membrane, flashing, and wall construction; as required to ensure that each element of the work performs properly, and that combined elements are waterproof and weathertight. Anchor products included in this Section securely to structural substrates, adequate to withstand lateral and thermal stresses as well as inward and outward loading pressures.
- B. Isolation: Where metal surfaces of units are installed in contact with dissimilar metal or corrosive substrates, including wood, apply bituminous coating on concealed metal surfaces, or provide other permanent separation as recommended by aluminum producer.

3.2 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces in accordance with manufacturer's instructions. Touch-up damaged metal coatings.
- B. Protection: Provide protective measures as required to ensure that work of this Section will be without damage or deterioration at time of substantial completion.

END OF SECTION 07 71 13

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 7: THERMAL AND MOISTURE PROTECTION
Section 07 71 23: Gutters and Downspouts

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Prefinished metal gutters leader heads and downspouts (exterior rain drainage).
- B. Exposed Preformed, Prefinished Gutters and Downspouts shall be 20 gauge (minimum) aluminum. See 2.1, A. below.
 - a. Finishes General: Apply coatings either before or after forming and fabricating metal, as required by coating process and as required for maximum coating performance capability. Protect coating either by application of strippable film or by packing plastic film or other suitable material between panels in a manner to properly protect the finish. Furnish air-drying spray finish in matching color for touch-up.
 - (1) Color: As selected by the Owner from manufacturer's full range of colors.
 - b. Fluoropolymer Coating: Manufacturer's standard two-coat, thermo-cured, full-strength 70 percent "Kynar 500" or equal coating consisting of a primer and a minimum 0.75-mil dry film thickness with a total minimum dry film thickness of 0.9 mil and 30 percent reflective gloss when tested in accordance with ASTM D 523.
 - (1) Durability: Provide coating that has been field tested under normal range of weathering conditions for minimum of 20 years without significant peel, blister, flake, chip, crack or check in finish; without chalking in excess of No. 8 in accordance with ASTM D 659; and without fading in excess of 5 NBS units.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract.
- B. Product data, Flashing, Sheet Metal, and Accessories: Manufacturer's technical product data, installation instructions and general recommendations for each specified sheet material and fabricated product.
- C. Samples of the following flashing, sheet metal, and accessory items:
 - 1. 8-inch-square samples of specified sheet materials to be exposed as finished surfaces.
 - 2. 12-inch-long samples of factory-fabricated products exposed as finished work. Provide complete with specified factory finish.
- D. Shop drawings showing layout, profiles, methods of joining, and anchorages details, including

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

flashings, trim units, gutters and downspouts. Provide layouts at 1/4-inch scale and details at 3-inch scale.

1.4 PROJECT CONDITIONS

- A. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

PART 2 - PRODUCTS

2.1 SHEET METAL FLASHING AND TRIM MATERIALS

- A. Sheet Aluminum: ASTM B 209, alloy 3003, temper H14, finished with Galvalume (55% aluminum 45% zinc alloy) applied by continuous hot dip method (Triple spot minimum 0.55 ounce per square foot per ASTM A-792, 0.032-inch thick (20 gage) except as otherwise indicated. Use for gutters and downspouts.

2.2 FABRICATED UNITS

- A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.
- B. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. For metal other than aluminum, tin edges to be seamed, form seams, and solder. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.
- C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in work cannot be used or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- D. Sealant Joints: Where movable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.
- E. Separations: Provide for separation of metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.
- F. Aluminum Extrusion Units: Fabricate extruded aluminum running units with formed or extruded aluminum joint covers for installation behind main members where possible. Fabricate mitered and welded corner units.

PART 3 - EXECUTION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3.1 INSTALLATION REQUIREMENTS

- A. General: Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations and with SMACNA "Architectural Sheet Metal Manual." Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.
- B. Underlayment: Where stainless steel or aluminum is to be installed directly on cementitious or wood substrates, install a slip sheet of red rosin paper and a course of polyethylene underlayment.
- C. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.
- D. Install continuous gutter guards on gutters, arranged as hinged units to swing open for cleaning gutters. Install "beehive"-type strainer-guard at conductor heads, removable for cleaning downspouts.

3.2 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.
- B. Protection: Advise General Contractor of required procedures for surveillance and protection of sheet metal work during construction to ensure that work will be without damage or deterioration other than natural weathering at time of Final Acceptance.

END OF SECTION 07 71 23

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 7: THERMAL AND MOISTURE PROTECTION
Section 07 84 00: Firestopping

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section.

1.2 SUMMARY

- A. This Section includes firestopping for the following:
1. Penetrations through fire-resistance-rated floor and roof construction including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
 2. Penetrations through fire-resistance-rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
 3. Penetrations through smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.
 4. Sealant joints in fire-resistance-rated construction.
 5. Specific openings at / between all main floor levels and plenum level. (Note: This Firestopping not required at any balcony level openings at chases.) This Firestopping will be completed by Firestopping contractor on site. See Item A.1 above. This Firestopping is not required at any cell module chase opening or otherwise if a part of the smoke evacuation system.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Division 3 Section "Cast-In-Place Concrete" for construction of openings in concrete slabs.
 2. Division 4 Section "Unit Masonry" for joint fillers for non-fire-resistive-rated masonry construction.
 3. Division 7 Section "Building Insulation" for safing insulation and accessories.
 4. Division 7 Section "Joint Sealants" for non-fire-resistive-rated joint sealants.
 5. Division 13 Section 13135 Equipped Precast Detention Modules.
 6. Division 15 Sections specifying ducts and piping penetrations.
 7. Division 16 Sections specifying cable and conduit penetrations.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. General: Provide firestopping systems that are produced and installed to resist the spread of fire, according to requirements indicated, and the passage of smoke and other gases.
- B. F-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding the fire-resistance rating of the constructions penetrated.
- C. T-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with T ratings, in addition to F ratings, as determined per ASTM E 814, where

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

indicated and where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas. T-rated assemblies are required where the following conditions exist:

1. Where firestop systems protect penetrations located outside of wall cavities.
 2. Where firestop systems protect penetrations located outside fire-resistive shaft enclosures.
 3. Where firestop systems protect penetrations located in construction containing doors required to have a temperature-rise rating.
 4. Where firestop systems protect penetrating items larger than a 4-inch-diameter nominal pipe or 16 sq. in. in overall cross-sectional area.
- D. Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings indicated, as determined per ASTM E 119, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.
- E. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.
- a. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 - b. For floor penetrations with annular spaces exceeding 4 inches or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means.
 - c. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- F. For firestopping exposed to view, provide products with flame-spread values of less than 25 and smoke-developed values of less than 450, as determined per ASTM E 84.

1.4 SUBMITTALS

- A. General: Submit the following according to Conditions of Contract.
- B. Product data for each type of product specified.
1. Certification by firestopping manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and are nontoxic to building occupants.
- C. Product certificates signed by manufacturers of firestopping products certifying that their products comply with specified requirements.
- D. Product test reports from, and based on tests performed by, a qualified testing and inspecting agency evidencing compliance of firestopping with requirements based on comprehensive testing of current products.
- E. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.

1.5 QUALITY ASSURANCE

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Fire-Test-Response Characteristics: Provide firestopping that complies with the following requirements and those specified under the "System Performance Requirements" article:
1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, Warnock Hersey, or another agency performing testing and follow-up inspection services for firestop systems that is acceptable to authorities having jurisdiction.
 2. Through-penetration firestop systems are identical to those tested per ASTM E 814 under conditions where positive furnace pressure differential of at least 0.01 inch of water is maintained at a distance of 0.78 inch below the fill materials surrounding the penetrating items in the test assembly. Provide rated systems complying with the following requirements:
 - a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
 - b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by UL in their "Fire Resistance Directory," by Warnock Hersey, or by another qualified testing and inspecting agency.
 3. Fire-resistive joint sealant systems are identical to those tested for fire-response characteristics per ASTM E 119 under conditions where the positive furnace pressure differential is at least 0.01 inch of water, as measured 0.78 inch from the face exposed to furnace fire. Provide systems complying with the following requirements:
 - a. Fire-Resistance Ratings of Joint Sealants: As indicated by reference to design designations listed by UL in their "Fire Resistance Directory" or by another qualified testing and inspecting agency.
 - b. Joint sealants, including backing materials, bear classification marking of qualified testing and inspection agency.
- B. Information on drawings referring to specific design designations of through-penetration firestop systems is intended to establish requirements for performance based on conditions that are expected to exist during installation. Any changes in conditions and designated systems require the Architect's prior approval. Submit documentation showing that the performance of proposed substitutions equals or exceeds that of the systems they would replace and are acceptable to authorities having jurisdiction.
- C. Installer Qualifications: Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary experience, staff, and training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Construction Manager or to an Installer engaged by the Construction Manager does not in itself confer qualification on the buyer.
- D. Single-Source Responsibility: Obtain through-penetration firestop systems for each kind of penetration and construction condition indicated from a single manufacturer.
- E. Provide firestopping products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

Microscopy."

- F. Coordinating Work: Coordinate construction of openings and penetrating items to ensure that designated through-penetration firestop systems are installed per specified requirements.
- G. Owner will employ and pay a qualified inspection agency to check installed firestopping systems for compliance with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver firestopping products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.
- B. Store and handle firestopping materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Conditions: Do not install firestopping when ambient or substrate temperatures are outside limits permitted by firestopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilation: Ventilate firestopping per firestopping manufacturers' instructions by natural means or, where this is inadequate, forced air circulation.

1.8 SEQUENCING AND SCHEDULING

- A. Notify Owner's inspection agency at least 1 week in advance of firestopping installations; confirm dates and times on days preceding each series of installations.
- B. Do not cover up those firestopping installations that will become concealed behind other construction until Owner's inspection agency and authorities having jurisdiction, if required, have examined each installation.

PART 2 - PRODUCTS

2.1 FIRESTOPPING, GENERAL

- A. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.
- B. Accessories: Provide components for each firestopping system that are needed to install fill materials and to comply with "System Performance Requirements" article in Part 1. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistance-rated systems. Accessories include but are not limited to the following items:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Permanent forming/damming/backing materials including the following:
 - a. Semirefractory fiber (mineral wool) insulation.
 - b. Ceramic fiber.
 - c. Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.
 - d. Fire-rated formboard.
 - e. Joint fillers for joint sealants.
 2. Temporary forming materials.
 3. Substrate primers.
 4. Collars.
 5. Steel sleeves.
- C. Applications: Provide firestopping systems composed of materials specified in this Section that comply with system performance and other requirements.
- D. Firestopping systems for 2-hour rated (minimum) fire resistance at all main floor levels and attic shall be equal to 3M Fire Protection products systems C-AJ-8085 / C-AJ-8106 / FF-D-1021 / and WW-D-1023. These systems shall be as tested and listed by Underwriters Laboratories in compliance with ASTM E814 and UL1479 and as specified herein. The installation of these systems shall be applicable at all concealed chases and openings at main floor levels and attic. (No requirements for ratings at balcony level floors exists.) This Firestopping is not required at main floor levels at cell module chases or elsewhere if openings are a part of smoke evacuation system. See mechanical drawings.
ALL Contractors are to use the same manufacturer for firestopping products.

2.2 FILL MATERIALS FOR THROUGH-PENETRATION FIRESTOP SYSTEMS

- A. Ceramic-Fiber and Mastic Coating: Ceramic fibers in bulk form formulated for use with mastic coating, and ceramic fiber manufacturer's mastic coating.
- B. Ceramic-Fiber Sealant: Single-component formulation of ceramic fibers and inorganic binders.
- C. Endothermic, Latex Compound Sealant: Single-component, endothermic, latex formulation.
- D. Intumescent, Latex Sealant: Single-component, intumescent, latex formulation.
- E. Intumescent Putty: Nonhardening, dielectric, water-resistant putty containing no solvents, inorganic fibers, or silicone compounds.
- F. Intumescent Wrap Strips: Single-component, elastomeric sheet with aluminum foil on one side.
- G. Job-Mixed Vinyl Compound: Prepackaged vinyl-based powder product for mixing with water at Project site to produce a paintable compound, passing ASTM E 136, with flame-spread and smoke-developed ratings of zero per ASTM E 84.
- H. Mortar: Prepackaged dry mix composed of a blend of inorganic binders, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking,

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

homogenous mortar.

- I. Pillows/Bags: Re-usable, heat-expanding pillows/bags composed of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.
- J. Silicone Foam: Two-component, silicone-based liquid elastomer that, when mixed, expands and cures in place to produce a flexible, nonshrinking foam.
- K. Silicone Sealant: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealant of grade indicated below:
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping/ gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
 - 2. Grade for Horizontal Surfaces: Pourable (self-leveling) grade for openings in floors and other horizontal surfaces.
 - 3. Grade for Vertical Surfaces: Nonsag grade for openings in vertical and other surfaces.
- L. Solvent-Release-Curing Intumescent Sealant: Solvent-release-curing, single-component, synthetic-polymer-based sealant of grade indicated below:
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping/ gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
 - 2. Grade for Horizontal Surfaces: Pourable (self-leveling) grade for openings in floors and other horizontal surfaces.
 - 3. Grade for Vertical Surfaces: Nonsag grade for openings in vertical and other surfaces.
- M. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Ceramic-Fiber and Mastic Coating:
 - a. FireMaster Bulk and FireMaster Mastic, Thermal Ceramics.
 - 2. Ceramic-Fiber Sealant:
 - a. Metacaulk 525, The RectorSeal Corporation.
 - 3. Endothermic, Latex Sealant:
 - a. Fyre-Shield, Tremco Inc.
 - 4. Endothermic, Latex Compounds:
 - a.. Flame-Safe FS500/600 Series, International Protective Coatings Corp.
 - b. Flame-Safe FS900/FST900 Series, International Protective Coatings Corp.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

5. Intumescent Latex Sealant:
 - a. Metacaulk 950, The RectorSeal Corporation.
 - b. Fire Barrier CP 25WB Caulk, 3M Fire Protection Products.
6. Intumescent Putty:
 - a. Pensil 500 Intumescent Putty, General Electric Co.
 - b. Flame-Safe FSP1000 Putty, International Protective Coatings Corp.
 - c. Fire Barrier Moldable Putty, 3M Fire Protection Products.
7. Intumescent Wrap Strips:
 - a. Dow Corning Fire Stop Intumescent Wrap Strip 2002, Dow Corning Corp.
 - b. CS2420 Intumescent Wrap, Hilti Construction Chemicals, Inc.
 - c. Fire Barrier FS-195 Wrap/Strip, 3M Fire Protection Products.
8. Job-Mixed Vinyl Compound:
 - a. USG Firecode Compound, United States Gypsum Co.
9. Mortar:
 - a. K-2 Firestop Mortar, Bio Fireshield, Inc.
 - b. Novasit K-10 Firestop Mortar, Bio Fireshield, Inc.
 - c. KBS-Mortar Seal, International Protective Coatings Corp.
10. Pillows/Bags:
 - a. Firestop Pillows, Bio Fireshield, Inc.
 - b. KBS Sealbags, International Protective Coatings Corp.
11. Silicone Foams:
 - a. Dow Corning Fire Stop Foam 2001, Dow Corning Corp.
 - b. Pensil 200 Foam, General Electric Co.
12. Silicone Sealants:
 - a. Dow Corning Firestop Sealant 2000, Dow Corning Corp.
 - b. Dow Corning Firestop Sealant SL 2003, Dow Corning Corp.
 - c. Pensil 100 Firestop Sealant, General Electric Co.
 - d. CS240 Firestop Sealant, Hilti Construction Chemicals, Inc.
 - e. Metacaulk 835, The RectorSeal Corporation.
 - f. Metacaulk 880, The RectorSeal Corporation.
 - g. Fyre-Sil, Tremco Inc.
 - h. Fyre-Sil S/L, Tremco Inc.
13. Solvent-Release-Curing Intumescent Sealants:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Biostop 500 Intumescent Firestop Caulk, Bio Fireshield, Inc.
- b. Fire Barrier CP 25N/S Caulk, 3M Fire Protection Products.
- c. Fire Barrier CP 25S/L Caulk, 3M Fire Protection Products.

14. Fire Resistant forming / packing Material:

- a. Equal to 3M Fire Protection Products mineral wool 3" or 4" batt insulation / 4PCF.

15. Fire Resistant Void / Cavity Fill Material:

- a. Equal to 3M Fire Protection Products Firedam Spray 100.

16. Fire Resistant Composite Sheets:

- a. Equal to 3M Fire Protection Products CS-195 + Composite Sheet.

2.3 FIRE-RESISTIVE ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that complies with ASTM C 920 requirements, including those referenced for Type, Grade, Class, and Uses, and requirements specified in this Section applicable to fire-resistive joint sealants.
- B. Sealant Colors: Provide color of exposed joint sealants to comply with the following:
 - 1. Provide custom colors to match Architect's samples.
 - 2. Match colors indicated by reference to manufacturer's standard designations.
 - 3. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.
- C. Single-Component, Neutral-Curing Silicone Sealant: Type S; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, G, A, and (as applicable to joint substrates indicated) O.
 - 1. Additional Movement Capability: Provide sealant with the capability to withstand the following percentage changes in joint width existing at time of installation, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, and remain in compliance with other requirements of ASTM C 920 for uses indicated:
 - a. 50 percent movement in both extension and compression for a total of 100 percent movement.
- D. Multicomponent, Nonsag, Urethane Sealant: Type M; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, A, and (as applicable to joint substrates indicated) O.
 - 1. Additional Movement Capability: Provide sealant with the capability to withstand the following percentage change in joint width existing at time of installation, when tested

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

for adhesion and cohesion under maximum cyclic movement per ASTM C 719, and remain in compliance with other requirements of ASTM C 920 for uses indicated:

- A. 40 percent movement in extension and 25 percent in compression for a total of 65 percent movement.
- E. Single-Component, Nonsag, Urethane Sealant: Type S; Grade NS; Class 25; and Uses NT, M, A, and (as applicable to joint substrates indicated) O.
- F. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Single-Component, Neutral-Curing, Silicone Sealant:
 - a. Dow Corning 790, Dow Corning Corp.
 - b. Dow Corning 795, Dow Corning Corp.
 - c. Silpruf, General Electric Co.
 - d. Ultraglaze, General Electric Co.
 - e. 864, Pecora Corp.
 - 2. Multicomponent, Nonsag, Urethane Sealant:
 - a. Vulkem 922, Mameco International Inc.
 - b. Dynflex, Pecora Corp.
 - c. Dynatred, Pecora Corp.
 - d. Dynatrol II, Pecora Corp.
 - e. Sikaflex 2cn NS, Sika Corp.
 - f. Sonolastic NP 2, Sonneborn Building Products Div., ChemRex Inc.
 - g. Dymeric, Tremco Inc.
 - 3. Single-Component, Nonsag, Urethane Sealant:
 - a. Isoflex 880 GB, Harry S. Peterson Co., Inc.
 - b. Isoflex 881, Harry S. Peterson Co., Inc.
 - c. Vulkem 921, Mameco International Inc.
 - d. Sikaflex--15LM, Sika Corp.

2.4 MIXING

- A. For those products requiring mixing prior to application, comply with firestopping manufacturer's directions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce firestopping products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting

performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:
 - 1. Remove all foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.
 - 2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form release agents from concrete.
- B. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

3.3 INSTALLING THROUGH-PENETRATION FIRESTOPS

- A. General: Comply with the "System Performance Requirements" article in Part 1 and the through-penetration firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.
- B. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross-sectional shapes and depths required to achieve fire ratings of designated through-penetration firestop systems. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:
 - 1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 INSTALLING FIRE-RESISTIVE JOINT SEALANTS

- A. General: Comply with the "System Performance Requirements" article in Part 1, with ASTM

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

C 1193, and with the sealant manufacturer's installation instructions and drawings pertaining to products and applications indicated.

- B. Install joint fillers to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability and develop fire-resistance rating required.
- C. Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint width that optimum sealant movement capability. Install sealants at the same time joint fillers are installed.
- D. Tool nonsag sealants immediately after sealant application and prior to the time skinning or curing begins. Form smooth, uniform beads of configuration indicated or required to produce fire-resistance rating, as well as to eliminate air pockets, and to ensure contact and adhesion of sealants with sides of joint. Remove excess sealant from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.5 FIELD QUALITY CONTROL

- A. Inspecting agency employed and paid by Owner will examine completed firestopping to determine, in general, if it is being installed in compliance with requirements.
- B. Inspecting agency will report observations promptly and in writing to Construction Manager and Architect.
- C. Do not proceed to enclose firestopping with other construction until reports of examinations are issued.
- D. Where deficiencies are found, repair or replace firestopping so that it complies with requirements.

3.6 CLEANING

- A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.
- B. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to produce firestopping complying with specified requirements.

END OF SECTION 07 84 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 7: Thermal and Moisture Protection
Section 07 92 00: Joint Sealants

Part 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this Section.

1.2 SUMMARY:

- A. This Section includes joint sealants which includes, but is not limited to the following locations:
1. Exterior joints in vertical surfaces and nontraffic horizontal surfaces as indicated below:
 - a. Control and expansion joints in cast-in-place concrete.
 - b. Control and expansion joints in unit masonry.
 - c. Joints between different materials listed above.
 - d. Control and expansion joints in ceiling and overhead surfaces.
 - e. Control and expansion joints at precast concrete cell modules.
 - f. Other joints as indicated.
 2. Exterior joints in horizontal traffic surfaces as indicated below:
 - a. Control, expansion and isolation joints in cast-in-place concrete slabs.
 - b. Joints between different materials listed above.
 - c. Other joints as indicated.
 3. Interior joints in vertical surfaces and horizontal nontraffic surfaces as indicated below:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Joints between tops of load bearing and non-load-bearing unit masonry walls and underside of hollow core panels and cast-in-

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

place concrete slabs and beams.

- d. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
 - e. Joints on underside of precast beams, hollow core planks.
 - f. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
 - g. Perimeter joints of toilet fixtures.
 - h. All joints in detention areas as specified in 2.1.G below.
 - i. All horizontal joints between adjacent concrete hollow core ceiling panels before acoustical spray is applied.
 - j. Other joints as indicated.
4. Interior joints in horizontal traffic surfaces as indicated below:
- a. Control and expansion joints in cast-in-place concrete slabs and at masonry wall intersections with the same.
 - b. Other joints as indicated.
5. Exterior joints in horizontal traffic surfaces as indicated below:
- a. All exterior mortar bed locations where masonry/Precast members abut.
 - b. All exterior locations where metal wall panels and dissimilar materials abut.
 - c. All exterior windows.
 - d. All exterior building perimeter locations where concrete paving abuts building shell.
 - e. Around all drains where occupied space is below.

1.3 SYSTEM PERFORMANCE REQUIREMENTS:

- A. Provide elastomeric joint sealants that have been produced and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.
- B. Provide joint sealants for interior applications that have been produced and installed to establish and maintain airtight continuous seals that are water resistant and cause no staining

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

or deterioration of joint substrates.

1.4 SUBMITTALS:

- A. General: Submit the following in accordance with Conditions of Contract.
- B. Product data from manufacturers for each joint sealant product required.
- C. Samples for verification purposes of each type and color of joint sealant required. Install joint sealant samples in 1/2 inch-wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Certificates from manufacturers of joint sealants attesting that their product comply with specification requirements and are suitable for the use indicated.
- E. Product test reports for each type of joint sealants indicated, evidencing compliance with requirements specified.

1.5 QUALITY ASSURANCE:

- A. Installer Qualifications: Engage an experienced installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.
- B. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.
- C. Pre-Installation Conference: Conduct conference at Project site to comply with requirements of the Division 1 Section covering this activity.

1.6 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants or other causes.

1.7 PROJECT CONDITIONS:

- A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.
 - 2. When joint substrates are wet.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.
- C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.8 SEQUENCING AND SCHEDULING:

- A. Sequence installation of joint sealants to occur not less than 21 nor more than 30 days after completion of waterproofing, unless otherwise indicated.

2.1 PRODUCTS

A. MATERIALS, GENERAL:

- 1. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- 2. Colors: Provide color of exposed joint sealants to comply with the following:

Provide selections made by Owner from manufacturer's full range of standard colors for products of type indicated and to match color of adjacent materials or use clear material as directed by Architect where two or more dissimilar materials and colors meet.

B. SOLVENT-RELEASE-CURING JOINT SEALANTS:

- 1. Butyl Sealant: Manufacturers standard one-part, nonsag, solvent-release-curing, polymerized butyl sealant complying with ASTM C 1085 and formulated with minimum of 75 percent solids to be nonstaining, paintable, and have a tack-free time of 24 hours or less.
- 2. Polyurethane Joint Sealant: Manufacturer's standard, multi-component, chemically curing, gun grade, non-sag, polyurethane sealant specially formulated for use in moving joints 1/4" and greater, conforming to ASTM C920, Type M, Grade NS, Class 25.
- 3. Available Products: Subject to compliance with requirements, solvent-release-curing joint sealants that may be incorporated in the Work include, but are not limited to the following:
- 4. Products: Subject to compliance with requirements, provide one of the following or an approved equal:
 - a. Butyl Sealant:
 - 1. "BC-158" Pecora Corp.
 - 2. "PTI 757", Protective Treatments, Inc.
 - 3. "Sonneborn Multi-Sealant", Sonneborn Building Products Div.,

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

ChemRex, Inc.

- b. Polyurethane Joint Sealant:
 - 1. "Dymeric 511" by Tremco, Inc.
- c. Elastomeric - NPI

C. LATEX JOINT SEALANTS:

- 1. General: Provide manufacturer's standard one-part, nonsag, mildew-resistant, paintable latex sealant of formulation indicated that is recommended for exposed applications on interior and protected exterior locations and that accommodates indicated percentage change in joint width existing at time of installation without failing either adhesively or cohesively.
- 2. Silicone Emulsion Sealant: Provide product complying with ASTM C 834 and, except for weight loss measured per ASTM C 792, with ASTM C 920 that accommodates joint movement of not more than 25 percent in both extension and compression for a total of 50 percent.
- 3. Available Products: Subject to compliance with requirements, latex joint sealants that may be incorporated in the Work include, but are not limited to, the following:
- 4. Products: Subject to compliance with requirements, provide one of the following or an approved equal:
 - a. Silicone-Emulsion Sealant:
 - 1. "Trade Mate Paintable Glazing Sealant", Dow Corning Corp.

D. ACOUSTICAL JOINT SEALANTS:

- 1. Product has flame spread and smoke developed ratings of less than 25 per ASTM E 84.
- 2. Acoustical Sealant for Concealed Joints: Manufacturer's standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound.
- 3. Available Products: Subject to compliance with requirements, acoustical joint sealants that may be incorporated in the Work include, but are not limited to, the following:
- 4. Products: Subject to compliance with requirements, provide one of the following or an approved equal:
 - a. Acoustical Sealant for Concealed Joints:
 - 1. "BA-98" Pecora Corp.

2. "Tremco Acoustical Sealant", Tremcol Inc.

E. JOINT SEALANT BACKING:

1. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers and other joint filler, and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
2. Plastic Foam Joint Filler: Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding stripes of flexible plastic foam of material indicated below and of size, shape and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

Open-cell polyurethane foam.

F. MISCELLANEOUS MATERIALS:

1. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealant-substrate tests and field tests.
2. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming in any way joint substrates and adjacent nonporous surfaces, and formulated to promote optimum adhesion of sealants with joint substrates.
3. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

G. SECURITY CAULKING:

1. Security caulk shall be equal to two component Sikadur 31, Hi-Mod Gel, high modulus, high strength, structural epoxy paste adhesive as manufactured by Sika Corporation. Install in strict accordance with manufacturers printed technical data and instruction, and as required by 1.2.A this section. Security caulk shall be used in all security areas and as shown on drawings below 8'-0" above floor and all areas within reach of inmates from balconies, stairs, and other similar areas. Security caulk shall be utilized at exposed joints between load bearing and non-load bearing hollow core and top of masonry walls.

3.1 EXECUTION

A. EXAMINATION:

1. Examine joints indicated to receive joint sealants with installer present, for compliance with requirements for joint configuration, installation tolerances, and

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

other conditions affecting joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

B. PREPARATION:

1. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer and the following requirements:
 - a. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - b. Clean concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
 - c. Remove laitance and form release agents from concrete.
 - d. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
2. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.
3. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

C. INSTALLATION OF JOINT SEALANTS:

1. General: Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
2. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
4. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:

Install joint filler of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - a. Do not leave gaps between ends of joint fillers.
 - b. Do not stretch, twist, puncture, or tear joint fillers.
 - c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.
5. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.
6. Tooling of Nonsag Sealants: Immediately after sealant applications and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
7. Provide concave joint configuration per Figure 5A in ASTM C 962, unless otherwise indicated.

D. CLEANING:

1. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

E. PROTECTION:

1. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so that installations with repaired areas are indistinguishable from original work.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

END OF SECTION 07 92 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 8: DOORS AND WINDOWS
Section 08 11 19: General Door Standard Steel Doors and Frames

PART I - GENERAL

1.1. RELATED DOCUMENTS

- A. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this Section.

1.2 SUMMARY

- A. This Section includes the following products manufactured in accordance with SDI Recommended Standards:
 - 1. Doors: Flush, hollow or composite construction standard steel doors for interior and exterior locations.
 - 2. Frames: Pressed steel frames for doors, transoms, sidelights, mullions, interior glazed panels, and other interior and exterior openings of following type:
 - a. Welded unit type.
 - 3. Assemblies: Provide standard steel door and frame assemblies as required for the following:
 - a. Labeled and fire rated.
 - 4. Provide factory primed doors and frames to be field painted.
- B. Painting primed doors and frames is specified in Division 9 Section "Painting."
- C. Wood doors are specified in another Division 8 Section.
- D. Door hardware is specified in another Division 8 Section.
- E. Glass and Glazing are specified in another Division 8 Section.
- F. Building in of anchors and grouting of frames in masonry construction is specified in Division 4.
- G. Security doors and frames are specified in Division 11, Section 11010.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract.
- B. Product data for each type of door and frame specified, including details of construction, materials, dimensions, hardware preparation, core, label compliance, sound ratings, profiles, and finishes.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- C. Shop drawings showing fabrication and installation of standard steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.
 - 1. Provide schedule of doors and frames using same reference numbers for details and openings as those on contract drawings.
 - 2. Indicate coordinate of glazing frames and stops with glass and glazing requirements.
- D. Label Construction Certification: For door assemblies required to be fire-rated and exceeding limitations of labeled assemblies, submit manufacturer's certification that each door and frame assembly has been constructed to conform to design, materials and construction equivalent to requirements for labeled construction.

1.4 QUALITY ASSURANCE

- A. Provide doors and frames complying with Steel Door Institute "Recommended Specifications Standard Steel Doors and Frames" ANSI/SDI-100 and as herein specified.
- B. Fire-Rated Door Assemblies: Units that comply with NFPA 80, are identical to door and frame assemblies whose fire resistance characteristics have been determined per ASTM E 152 and which are labeled and listed by UL, Factory Mutual, Warnock Hersey, or other testing and inspecting organization acceptable to authorities having jurisdiction.
 - 1. Temperature Rise Rating: At stairwell enclosures, provide doors which have Temperature Rise Rating of 450 deg F (232 deg C) maximum in 30 minutes of fire exposure.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.
- B. Inspect doors and frames upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged items as directed.
- C. Store doors and frames at building site under cover. Place units on minimum 4-inches high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4-inches spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering standard steel doors and frames which may be incorporated in the work include; but are not

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

limited to, the following:

1. Standard Steel Doors and Frames:
 - a. Ceco Corp.
 - b. Kewanee Corp.
 - c. Republic Builders Products.
 - d. Steelcraft Manufacturing Co.
 - e. Mesker Door

2.2 MATERIALS

- A. Hot-Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled and oiled, complying with ASTM A 569 and ASTM A 568.
- B. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366 and ASTM A 568.
- C. Galvanized Steel Sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 526, or drawing quality, ASTM A 642, hot dipped galvanized in accordance with ASTM A 525, with A60 or G60 coating designation, mill phosphatized.
- D. Supports and Anchors: Fabricate of not less than 18-gage sheet steel; galvanized where used with galvanized frames.
- E. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where items are to be built into exterior walls, hot-dip galvanize in compliance with ASTM A 153, Class C or D as applicable.
- F. Shop Applied Paint: Apply after fabrication.
 1. Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints complying with ANSI A224.1, "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames."

2.3 DOORS

- A. Provide metal doors of SDI grades and models specified below or as indicated on drawings or schedules:
 1. Interior Doors: ANSI/SDI-100, Grade II, heavy-duty, Model 3 or 4, minimum 18-gage cold-rolled sheet steel faces.
 2. Exterior or Special Doors as scheduled: ANSI/SDI-100, Grade III, extra heavy-duty, Model 4, minimum 16-gage galvanized steel faces.

2.4 FRAMES

- A. Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, of types and styles as shown on drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames of minimum 16-gage cold-rolled steel.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Fabricate frames with mitered or coped corners, welded construction
 2. Form exterior frames from 16-gage galvanized steel.
- B. Door Silencers: Except on weatherstripped frames, drill stops to receive 3 silencers on strike jambs of single-door frames and 2 silencers on heads of double-door frames.

2.5 FABRICATION

- A. Fabricate steel door and frame units to be rigid, neat in appearance and free from defects, warp or buckle. Wherever practicable, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory- assembled before shipment, to assure proper assembly at project site. Comply with ANSI/SDI-100 requirements.
1. Internal Construction: Manufacturer's standard honeycomb, polyurethane, polystyrene, unitized steel grid, vertical steel stiffeners, or rigid mineral fiber core with internal sound deadener on inside of face sheets where appropriate in accordance with SDI standards.
 2. Clearances: Not more than 1/8 inch at jambs and heads except between non-fire-rated pairs of doors not more than 1/4 inch. Not more than 3/4 inch at bottom.
- B. Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from only cold-rolled steel.
- C. Tolerances: Comply with SDI 117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Fabricate frames, concealed stiffeners, reinforcement, edge channels, louvers and moldings from either cold-rolled or hot-rolled steel.
- E. Fabricate exterior doors, panels, and frames from galvanized sheet steel in accordance with SDI-112. Close top and bottom edges of exterior doors as integral part of door construction or by addition of minimum 16-gage inverted steel channels.
- F. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware in accordance with final Door Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115 Series Specifications for door and frame preparation for hardware.
- G. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at project site.
- H. Locate hardware as indicated on final shop drawings or, if not indicated, in accordance with "Recommended Locations for Builder's Hardware on Standard Steel Doors and Frames," published by Door and Hardware Institute.
- I. Shop Painting: Clean, treat, and paint exposed surfaces of steel door and frame units, including galvanized surfaces.
1. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint.
- J. Glazing Stops: Minimum 20 gage steel or .040-inch-thick aluminum.
1. Provide non-removable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
 2. Provide screw applied removable glazing beads on inside of glass, louvers, and other panels in doors.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install standard steel doors, frames, and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified.
- B. Placing Frames: Comply with provisions of SDI-105 "Recommended Erection Instructions For Steel Frames," unless otherwise indicated.
1. Except for frames located at existing concrete, masonry or drywall installations, place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
 2. In masonry construction, locate 3 wall anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry Tee anchors.
 3. At existing concrete or masonry construction, provide 3 completed opening anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb, set frames and secure to adjacent construction with bolts and masonry anchorage devices.
 4. Install fire-rated frames in accordance with NFPA Standard No. 80.
 5. In metal stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. In closed steel stud partitions, attach wall anchors to studs with screws.
 6. In in-place drywall partitions install knock down slip-on drywall frames.
 7. Install asphalt paint in throat of frames at exterior HM to 12" AFF.
- C. Door Installation: Fit hollow metal doors accurately in frames, within clearances specified in ANSI/SDI-100.
1. Install fire-rated doors with clearances as specified in NFPA Standard No. 80.

3.2 ADJUST AND CLEAN

- A. Prime Coat Touch-up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.
- B. Protection Removal: Immediately prior to final inspection, remove protective plastic wrappings from prefinished doors.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- C. Final Adjustments: Check and readjust operating hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.

END OF SECTION 08 11 19

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 8: DOORS AND WINDOWS
Section 08 31 00: Access Doors (Non-Security Rated)

PART I - GENERAL

1.1 Related Documents

- A. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this Section.

1.2 Summary

- A. This Section includes doors for installation in the following types of construction:
 - 1. Gypsum drywall.
 - 2. Masonry
 - 3. Metal Wall Panels
 - 4. Cast-In-Place Concrete
 - 5. Precast Concrete
- B. Provide fire-rated access doors where required. Any access door penetrating a fire or smoke wall floor or ceiling indicated on life safety and reflecting ceiling plans shall bear a label and construction which meets the minimum requirements for the rating specified. See drawings.

1.3 Quality Assurance

- A. Fire-Resistance Ratings: Wherever a fire-resistance classification is required by the Life Safety Plan and other details, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in Underwriters Laboratories, Inc.; "Building Materials Directory" for rating shown.
 - 1. Provide UL Label on each fire-rated access door. Any access door penetrating a fire or smoke wall or hollow core ceiling indicated on life safety and reflected ceiling plans shall bear a label and construction which meets the minimum requirements for the rating specified. See drawings.

1.4 Project Conditions

- A. Variations: Obtain specific locations and sizes for required access doors from trades required access to concealed equipment, and indicated on submittal schedule.
- B. Special-Size Access Doors: Use where required or requested and as shown on all Plans, Elevations, Sections, Details and Interior Elevations.

PART II - PRODUCTS

2.1 GENERAL

- A. General: Furnish each access door assembly manufactured as an integral unit, complete with all parts and ready for installation.
- B. Steel Access Doors and Frames: Fabricate units of continuous welded steel construction,

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

unless otherwise indicated. Grind welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of support shown.

- C. Frames: Fabricate from 17-gauge steel.
 - 1. For fire rated units, provide manufacturer's standard insulated flush panel/doors, with continuous piano hinge and Self-closing mechanism.
- D. Locking Devices: Furnish flush, screwdriver-operated cam locks of number required to hold door in flush, smooth plane when closed.
 - 1. Provide one cylinder lock per access door. Furnish 2 keys per lock. Key all locks alike, unless otherwise scheduled.
- E. Drywall Access Doors: At decorative drywall ceilings in Lobbies, Courtrooms and Foyers, furnish and install a metal framing drywall bead recessed access door to accept a drywall panel door infill to match surrounding drywall finish.

Manufacturer – Equal to Williams Brothers Corporation WR-RDW, 777 Tapscott Road, Scarborough Ontario, Canada.

Install in drywall ceilings in strict accordance with manufacturers instructions and in sizes as required by discipline coordination outlined above.

PART 3 - EXECUTION

3.1 Installation

- A. Comply with manufacturer's instructions for installation of access doors in all applicable materials.
- B. Coordinate installation with work of other trades.
- C. Set frames accurately in position and securely attach to supports with face panels plumb or level in relation to adjacent finish surfaces.

3.2 Adjust and Clean

- A. Adjust hardware and panels after installation for proper operation.
- B. Remove and replace panels or frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08 31 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 8:

Section 08 71 00: Door Hardware – General Doors

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.

- B. This Section includes the following:

1. Hinges.
2. Pivots.
3. Spring hinges.
4. Lock cylinders and keys.
5. Lock and latch sets.
6. Bolts.
7. Push/pull units.
8. Closers.
9. Overhead holders.
10. Miscellaneous door control devices.
11. Door trim units.
12. Protection plates.
13. Weather stripping for exterior doors (except aluminum door and framed entrances).
14. Threshold.
15. Electro-mechanical locking devices.

- C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 8 Section "Standard Steel Doors and Frames" for silencers integral with hollow metal frames.
2. Division 8 Section "Custom Steel Doors and Frames" for silencers integral with hollow metal frames.
3. Division 8 Section "Flush Wood Doors" for factory prefitting and factory premachining of doors for door hardware.
4. Division 8 Section "Aluminum Entrances and Storefronts" for aluminum entrance door weatherstripping.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification sections.
- B. Product data including manufacturers' technical product data for each item of door hardware,

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.

- C. Final hardware schedule coordinated with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:
 - a. Type, style, function, size, and finish of each hardware item.
 - b. Name and manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of each hardware set cross referenced to indications on Drawings both on floor plans and in door and frame schedule.
 - e. Explanation of all abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for hardware.
 - g. Door and frame sizes and materials.
 - h. Keying information.
 - 2. Submittal Sequence: Submit final schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work that is critical in the Project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by door hardware, and other information essential to the coordinated review of schedule.
 - 3. Submittal Sequence: Submit initial draft of final schedule along with essential product data in order to facilitate the fabrication of other work that is critical in the Project construction schedule. Submit final schedule after samples, product data, coordination with shop drawings of other work, delivery schedules, and similar information has been completed and accepted.
 - 4. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.
- D. Samples of each type of exposed hardware unit in finish indicated and tagged with full description for coordination with schedule. Submit samples prior to submission of final hardware schedule.
 - 1. Samples will be returned to the supplier. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated in the Work, within limitations of keying coordination requirements.
- E. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.4 QUALITY ASSURANCE

- A. Single Source Responsibility: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer.
- B. Supplier - A recognized Builders Hardware supplier who has been furnishing hardware in the project's vicinity for a period of not less than two (2) years. And who is, or has in full time employment an Architectural Hardware Consultant (AHC) in good standing as certified by the Society of Architectural Council or equivalent, and who is a direct distributor of the products approved or warranty purposes. This paragraph will be strictly enforced. All schedules will be given by an AHC. Pre-bid approval of

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

suppliers is required. Suppliers must have demonstrated a willingness to provide support help with materials as required to properly supply and services the project. The following suppliers are accorded advance approval:

1. Mullins Building Products; Birmingham, Montgomery, AL
2. Building Specialties Company; Birmingham, Tuscaloosa, AL
3. Wagstaff-Taylor & Associates, Birmingham, AL
4. Brabner & Hollon, Mobile, AL
5. Commercial Door Products, Montgomery, AL
7. Builders Door & Hardware, Dothan, AL
8. Alabama Door & Hardware, Vance, AL
10. Kelley Brothers, Daphne, AL
11. Dothan Commercial Door, Dothan, AL
12. American Door, Santa Rosa Beach, FL
13. Warren Doors & Access Control, Pensacola, FL
14. Slone Door, Pensacola, FL

- C. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by UL, Warnock Hersey, FM, or other testing and inspecting organization acceptable to authorities having jurisdiction for use on types and sizes of doors indicated in compliance with requirements of fire-rated door and door frame labels.

1.5 PRODUCT HANDLING

- A. Tag each item or package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.
- B. Packaging of door hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.
- C. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.
- D. Deliver individually packaged door hardware items promptly to place of installation (shop or Project site).
- E. Provide secure lock-up for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of the Work will not be delayed by hardware losses both before and after installation.

1.6 MAINTENANCE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Requests for substitutions shall be submitted in writing to the architect 10 days prior to the project bid date.

1. Continuous Gear and Butt Hinges:

- a. Ives
- b. Select Products
- c. Bommer

2. Cylinders and Keys:

- a. Match existing key system used by owner.

3. Locks & Latches:

- a. Schlage L9000 Series, 06N design
- b. Falcon MA Series, DN design
- c. Sargent 8200 Series, LW1L

4. Overhead Surface Closers:

- a. LCN 4210/4510 Series – No Substitution Allowed

5. Exit Devices:

- c. Von Duprin 98 Series – No Substitution Allowed

6. Kick, Mop, and Armor Plates:

- a. Ives
- b. Hiawatha
- c. Trimco

7. Thresholds:

- a. Zero
- b. Door and Hardware Systems (DHSI)
- c. K. N. Crowder

8. Weather Stripping:

- a. Zero International (Allegion)
- b. Door and Hardware Systems (DHSI)
- c. K. N. Crowder

2.2 SCHEDULED HARDWARE

- A. Requirements for design, grade, function, size, and other distinctive qualities of each type of finish hardware are indicated in the "Hardware Schedule" at the end of this Section. Products are identified by using hardware designation numbers of the following:
1. Manufacturer's Product Designations: The product designation and name of one manufacturer are listed for each hardware type required for the purpose of establishing minimum requirements. Provide either the product designated or, where more than one manufacturer is specified under the Article "Manufacturers" in Part 2 for each hardware type, the comparable product of one of the other manufacturers that complies with requirements.
 2. ANSI/BHMA designations used elsewhere in this Section or in schedules to describe hardware items or to define quality or function are derived from the following standards. Provide products complying with these standards and requirements specified elsewhere in this Section.
 - a. Material and Finishes: ANSI/BHMA A156.18.

2.3 MATERIAL AND FABRICATION

- A. Base Metals: Produce hardware units of basic metal and forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units by applicable ANSI/BHMA A156 series standards for each type of hardware item and with ANSI/BHMA A156.18 for finish designations indicated. Do not furnish "optional" materials or forming methods for those indicated, except as otherwise specified.
- B. Base Metals: Produce hardware units of basic metal and forming method indicated using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units for finish designations indicated.
- C. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.

2.4 HINGES, BUTTS, AND PIVOTS

- A. Templates: New door frames: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units. Unless specified otherwise in the hardware sets, hinge size shall typically be 4 ½" x 4 ½". EXISTING door frames: match existing frame preparation/hinge gauge and match non-template hinge hole patterns. **Supplier to field verify.**
- B. Screws: Provide Phillips flat-head screws complying with the following requirements:
1. For metal doors and frames install machine screws into drilled and tapped holes.
 2. For wood doors and frames install wood screws.
 3. For fire-rated wood doors install #12 x 1-1/4-inch, threaded-to-the-head steel wood screws.
 4. Finish screw heads to match surface of hinges or pivots.
- C. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Out-Swing Exterior Doors: Non-removable pins.
 2. Out-Swing Corridor Doors with Locks: Non-removable pins.
 3. Interior Doors: Standard.
 4. Tips: Flat button and matching plug, finished to match leaves, except where hospital tip (HT) indicated.
- D. Number of Hinges: Provide number of hinges indicated but not less than 3 hinges per door leaf for doors 90 inches or less in height and one additional hinge for each 30 inches of additional height.
1. Fire-Rated Doors: Not less than 3 hinges per door leaf for doors 86 inches or less in height with same rule for additional hinges.

2.5 LOCK CYLINDERS AND KEYING

- A. Master key all locks to the owner's existing master key system. Field verify cylinder manufacturer and cylinder type. Provide standard 6-pin cylinders or key removable core cylinders as required to match existing key system. Match existing keyways. Key as directed by the owner. Provide brass temporary construction use cylinders for all exterior doors and all interior mechanical and electrical rooms. At the completion of the project the general contractor shall be responsible for the removal of temporary cylinders and for installation of permanent cylinders. Temporary cylinders shall be returned to the hardware supplier by the general contractor.
- B. Metals: Construct lock cylinder parts from brass or bronze, stainless steel, or nickel silver.
- C. Comply with Owner's instructions for master keying and, except as otherwise indicated, provide individual change key for each lock that is not designated to be keyed alike with a group of related locks.
1. Permanently inscribe each key with number of lock that identifies cylinder manufacturer's key symbol, and notation, "DO NOT DUPLICATE."
- D. Key Material: Provide keys of nickel silver only.
- E. Key Quantity: Furnish 4 change keys for each lock, 5 master keys for each master system, and 5 grandmaster keys for each grandmaster system. Provide 100 key blanks. Permanent change keys, permanent cores and permanent master keys shall be shipped direct to the owner's designated representative. Keys shall be individually packaged by key symbol.
1. Furnish 12 construction master keys and 2 construction control keys
- F. Provide one wall mounted key cabinet, Lund Deluxe 1200 Series. Hardware supplier shall tag all file keys, and set up key cabinet file records for owner use based upon the approved door hardware schedule.

2.6 LOCKS, LATCHES, AND BOLTS

- A. Strikes: New door frames: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set, unless otherwise indicated.
1. Provide flat lip strikes for locks with antifriction latch bolts as recommended by manufacturer.
 2. Provide extra long strike lips for locks used on frames with applied wood casing trim.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Provide recess type top strikes for bolts locking into head frames, unless otherwise indicated.
 4. Provide dust-proof strikes for foot bolts, except where special threshold construction provides non-recessed strike for bolt.
 5. Provide roller type strikes where recommended by manufacturer of the latch and lock units.
 6. Provide standard (open) strike plates for interior doors of residential units where wood door frames are used.
- B. Lock Throw: Provide 5/8-inch minimum throw of latch on pairs of doors. Comply with UL requirements for throw of bolts and latch bolts on rated fire openings.
1. Provide 1/2-inch minimum throw of latch for other bored and preassembled types of locks and 3/4-inch minimum throw of latch for mortise locks. Provide 1-inch minimum throw for all dead bolts.

2.7 PUSH/PULL UNITS

- A. Exposed Fasteners: Provide manufacturer's standard exposed fasteners for installation, thru-bolted for matched pairs but not for single units.
- B. Concealed Fasteners: Provide manufacturer's special concealed fastener system for installation, thru-bolted for matched pairs but not for single units.

2.8 CLOSERS AND DOOR CONTROL DEVICES

- A. Size of Units: Except as otherwise specifically indicated, comply with the manufacturer's recommendations for size of door control unit depending on size of door, exposure to weather, and anticipated frequency of use.
- B. Access-Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped, provide adjustable units complying with ANSI A117.1 provision for door opening force and delayed action closing.
- C. All door closer to be provided with cast iron bodies. All surface closers to have full covers. Closer case piston diameter to be minimum 1 1/2". Provide through bolt torx fasteners for installation of surface door closers.

2.9 DOOR TRIM UNITS

- A. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units consisting of either machine screws or self-tapping screws.
- B. Fabricate edge trim of stainless steel to fit door thickness in standard lengths or to match height of protection plates.
- C. Fabricate protection plates not more than 1-1/2 inches less than door width on hinge side and not more than 1/2 inch less than door width on pull side by height indicated. Plates shall be .050" thick stainless steel, **beveled all four edges**.

2.10 WEATHERSTRIPPING AND SEALS

- A. General: Provide continuous weather stripping on exterior doors and smoke, light, or sound seals on interior doors where indicated or scheduled. Provide non-corrosive fasteners for exterior applications and elsewhere as indicated. Provide types specified in hardware sets.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2.11 THRESHOLDS

- A. General: Except as otherwise indicated, provide standard metal threshold unit of type, size, and profile as shown or scheduled in the hardware sets.

2.12 HARDWARE FINISHES

- A. The designations used below, in schedules and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18, "Materials and Finishes," including coordination with the traditional U.S. finishes shown by certain manufacturers for their products. Provide door hardware in the following finishes for aluminum, hollow metal and wood doors:

Continuous Gear Hinges:	US28, Clear Anodized Aluminum
Butt Hinges:	Exterior 630, Interior: 652
Locks:	626, Satin Chrome
Cylinders:	Match Lockset or Exit Device.
Surface and Concealed Closers:	689
Exit Devices:	US26D, with 630 Touch Pads
Thresholds:	US28
Weather Strip W/Metal Retainer:	US28
Flat Goods	630
Miscellaneous Items:	626 or 630

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Architect.
- "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.
 - NWWDA Industry Standard I.S.1.7, "Hardware Locations for Wood Flush Doors."
- B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.
- C. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- D. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- E. Set threshold for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in Division 7 Section "Joint Sealers."
- F. Weather stripping and Seals: Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
 MENTAL HEALTH / MEDICAL UNIT
 ANNISTON, ALABAMA

3.2 ADJUSTING, CLEANING, AND DEMONSTRATING

- A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.
 - 1. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- B. Clean adjacent surfaces soiled by hardware installation.

3.3 HARDWARE SCHEDULE

- A. General: Provide hardware for each door to comply with requirements of Section 08710 - "Door Hardware," and in the following schedule of hardware sets. Door numbers are posted with in the hardware sets indicating their assignment to this set.
 - 1. Hardware sets indicate quantity, item, manufacturer and product designation, size, and finish or color, as applicable. Provide hardware for all doors shown on drawing floor plans whether specified in the door hardware sets or not.

Hardware Sets

HARDWARE SET: 101

DOOR NUMBER:

158	159	160	161	167
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EACH TO HAVE:

3	HINGE	5BB1 4.5 X 4.5 NRP TORX (5" X 4.5" @ DOORS 158, 159 ONLY)	IVE
1	STOREROOM LOCK	L9080L TORX	SCH
1	CYLINDER	TYPE AS REQ'D	
1	SURFACE CLOSER	4510 TB TORX (OMIT AT DOOR 167)	LCN
1	WALL STOP	WS401/402CVX TORX	IVE
1	OVERHEAD STOP	90S SNB (DOOR 167 ONLY)	IVE
1	GASKET SEAL	188S-BK-PSA-ZAG (FIRE DOORS ONLY)	ZER
3	SILENCERS	SR64	IVE
1	DOOR POSITION SWITCH	7764 (PROVIDE ONLY WHERE DESIGNATED ON ELECTRONIC SECURITY DRAWINGS)	SCE

LOCK FUNCTION: KEYED CYLINDER OUTSIDE AT ALL TIMES. INSIDE LEVER PROVIDES FREE EGRESS AT ALL TIMES.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
 MENTAL HEALTH / MEDICAL UNIT
 ANNISTON, ALABAMA

HARDWARE SET: 102

DOOR NUMBER:
 148

EACH TO HAVE:

3	HINGE	5BB1HW 4.5 X 4.5 NRP TORX	IVE
1	ENTRY LOCK	L9456L XL13-439 TORX	SCH
1	CYLINDER	TYPE AS REQ'D	
1	SURFACE CLOSER	4510 TB TORX	LCN
1	WALL STOP	WS401/402CVX TORX	IVE
3	SILENCERS	SR64	IVE

LOCK FUNCTION: KEY CYLINDER OUTSIDE; THUMBTURN INSIDE; DEADBOLT AND LATCHBOLT. LATCHBOLT RETRACTED BY LEVER (OR KNOB) FROM EITHER SIDE. OUTSIDE LEVER IS MADE INOPERATIVE WHEN DEADBOLT IS THROWN BY KEY OUTSIDE OR BY INSIDE THUMBTURN. INSIDE LEVER PROVIDES FREE EGRESS AT ALL TIMES. KEY OUTSIDE RETRACTS DEADBOLT AND UNLOCKS OUTSIDE LEVER; XL13-439 OPTION ALLOWS KEY TO RETRACT DEADBOLT OVERRIDING THUMBTURN IF BEING HELD IN LOCKED POSITION ▯ ROTATING INSIDE LEVER RETRACTS BOTH DEADBOLT AND LATCHBOLT AND UNLOCKS OUTSIDE LEVER ▯ INSIDE LEVER ALWAYS FREE FOR IMMEDIATE EGRESS

HARDWARE SET: 103

DOOR NUMBER:

109 149 152 153 133 146

EACH TO HAVE:

3	HINGE	5BB1HW 4.5 X 4.5 NRP TORX	IVE
1	CLASSROOM LOCK	L9070L TORX	SCH
1	CYLINDER	TYPE AS REQ'D	
1	SURFACE CLOSER	4510 TB TORX (OMIT @ DOOR 149)	LCN
1	WALL STOP	WS401/402CVX TORX	IVE
1	GASKET SEAL	188S-BK-PSA-ZAG (FIRE DOORS ONLY)	ZER
3	SILENCERS	SR64	IVE
1	DOOR POSITION SWITCH	7764 (PROVIDE ONLY WHERE DESIGNATED ON ELECTRONIC SECURITY DRAWINGS)	SCE

LOCK FUNCTION: KEYED CYLINDER OUTSIDE LOCKS OR UNLOCKS OUTSIDE LEVER. INSIDE LEVER PROVIDES FREE EGRESS AT ALL TIMES.

HARDWARE SET: 104

DOOR NUMBER:

147

EACH TO HAVE:

3	HINGE	5BB1HW 4.5 X 4.5 NRP	IVE
1	PRIVACY W/DEADBOLT	L9440 L583-363 L283-721	SCH
1	SURFACE CLOSER	4210 TB TORX	LCN
1	WALL STOP	WS401/402CVX TORX	IVE
3	SILENCERS	SR64	IVE

LOCK FUNCTION: EMERGENCY THUMBTURN ACCESS OUTSIDE; THUMBTURN INSIDE; DEADBOLT AND LATCHBOLT ▯ LATCHBOLT RETRACTED BY LEVER (OR KNOB) FROM EITHER SIDE ▯ OUTSIDE LEVER IS MADE INOPERATIVE WHEN DEADBOLT IS THROWN BY ROTATING INSIDE THUMBTURN; REMOVE ACCESS HOLE COVER, INSERT EMERGENCY THUMBTURN (FURNISHED) AND ROTATE ▯ ROTATING INSIDE THUMBTURN UNLOCKS OUTSIDE LEVER; TURNING INSIDE LEVER RETRACTS BOTH DEADBOLT AND LATCHBOLT AND UNLOCKS OUTSIDE LEVER ▯ INSIDE LEVER ALWAYS FREE FOR IMMEDIATE EGRESS

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
 MENTAL HEALTH / MEDICAL UNIT
 ANNISTON, ALABAMA

HARDWARE SET: 105

DOOR NUMBER:
 151

EACH TO HAVE:

3	HINGE	5BB1HW 4.5 X 4.5 NRP TORX	IVE
1	ENTRY LOCK W/OUTSIDE OCCUPANCY INDICATOR	L9456L XL13-439 OS-OCC TORX	SCH
1	CYLINDER	TYPE AS REQ'D	
1	SURFACE CLOSER	4510 TB TORX	LCN
1	WALL STOP	WS401/402CVX TORX	IVE
1	GASKET SEAL	188S-BK-PSA-ZAG	ZER

LOCK FUNCTION: KEY CYLINDER OUTSIDE; THUMBTURN INSIDE; DEADBOLT AND LATCHBOLT. LATCHBOLT RETRACTED BY LEVER (OR KNOB) FROM EITHER SIDE. OUTSIDE LEVER IS MADE INOPERATIVE WHEN DEADBOLT IS THROWN BY KEY OUTSIDE OR BY INSIDE THUMBTURN. INSIDE LEVER PROVIDES FREE EGRESS AT ALL TIMES. KEY OUTSIDE RETRACTS DEADBOLT AND UNLOCKS OUTSIDE LEVER; XL13-439 OPTION ALLOWS KEY TO RETRACT DEADBOLT OVERRIDING THUMBTURN IF BEING HELD IN LOCKED POSITION □ ROTATING INSIDE LEVER RETRACTS BOTH DEADBOLT AND LATCHBOLT AND UNLOCKS OUTSIDE LEVER □ INSIDE LEVER ALWAYS FREE FOR IMMEDIATE EGRESS

HARDWARE SET: 106

DOOR NUMBER:
 163

EACH TO HAVE:

6	HINGE	5BB1HW 5 X 4.5 NRP TORX	IVE
2	EXIT DEVICES	9827-EO-F-LBR-SNB	VON
2	SURFACE CLOSER	4210 TB TORX	LCN
2	ELECTRO-MAGNETIC WALL MOUNTED DOOR HOLDERS	SEM-7850	LCN
1	GASKET SEAL	188S-BK-PSA-ZAG	ZER
1	MEETING EDGE SEAL	383AA-TORX	ZER

NOTE: WALL MAGNETS SHALL BE CONNECTED TO FIRE ALARM SYSTEM AND SHALL RELEASE DOORS UPON FIRE ALARM ACTIVATION.

Manufacturer List

<u>Code</u>	<u>Name</u>
SCH	Schlage
ZER	Zero
IVE	Ives
GLY	Glynn Johnson
LCN	LCN Closers
VON	Von Duprin

End of section

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 8: DOORS AND WINDOWS
Section 08 80 00: Glazing (Non-Security)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and any general provisions of the Contract all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section.

1.2 DELIVERY, STORAGE AND HANDLING

- A. Protect glass and glazing materials during delivery, storage and handling to comply with manufacturer's directions and as required to prevent edge damage to glass, and damage to glass and glazing materials from effects of moisture including condensation, of temperature changes, of direct exposure to sun, and from other causes.

1.3 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing material manufacturer or when joint substrates are wet due to rain, frost, condensation or other causes.
 - 1. Install liquid sealants at ambient and substrate temperatures above 40 deg. F (4.4 deg. C).

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

- A. Primary Glass Standard: Provide primary glass which complies with ASTM C 1036 requirements, including those indicated by reference to type, class, quality, and, if applicable, form, finish, mesh and pattern.
- B. Heat-Treated Glass Standard: Provide heat-treated glass which complies with ASTM C1048 requirements, including those indicated by reference to kind, condition, type, quality, class, and if applicable, form, finish and pattern.
- C. Sizes: Fabricate glass to sizes required for glazing openings indicated, with edge clearances and tolerances complying with recommendations of glass manufacturer. Provide thicknesses indicated or, of not otherwise indicated, as recommended by glass manufacturer for application indicated.

2.2 GLASS PRODUCTS, SPECIFIC

- A. Safety glazing shall be 1/4" or 3/8" Tempered.
- B. Insulated glass where indicated shall be 1" insulating clear glass composed of 1/4" clear outboard lite - 1/2" airspace and 1/4" clear inboard lite (tempered where required by law). Equivalent to Solar Ban 70, low e.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

Type 1 :

1" INSULATING GLAZING-1/4" THICK LITES, HIGH PERFORMANCE REFLECTIVE SOFT COAT LOW-E (#3) GLASS EQUAL TO PPG SOLAR COOL GRAY REFLECTIVE GLASS ON THE OUTBOARD LITE, SOLAR BAN 60 ON THE #3 SURFACE WITH A VISIBLE LIGHT TRANSMITTANCE OF 14 TO 17%, A .29 OR BETTER U-VALUE AND A S.H.G.C. OF .16 TO .18.

Type 5:

1" INSULATING GLAZING-1/4" THICK LITES, HIGH PERFORMANCE REFLECTIVE SOFT COAT LOW-E (#3) GLASS EQUAL TO PPG SOLAR COOL GRAY REFLECTIVE GLASS ON THE OUTBOARD LITE, SOLAR BAN 60 ON THE #3 SURFACE WITH A VISIBLE LIGHT TRANSMITTANCE OF 14 TO 17%, A .29 OR BETTER U-VALUE AND A S.H.G.C. OF .16 TO .18. WITH FULLY TEMPERED GLAZING ASSEMBLY

- C. Wire glass shall be 1/4" polished equal to Misco.
- D. Non-framed mirrors shall be 1/4" No. 1 quality polished plate glass, electrolytically copper plated with invisible mounting.
- E. Glazing tapes and sealants shall be as recommended by glass manufacturers.
- F. Opaque Spandrel glazing where shown on drawings shall be opaque, in thickness to match adjacent glazing and shall match adjacent glazing in appearance.

2.3 PRIMARY GLASS PRODUCTS

- A. Clear Float Glass: Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select).
- B. Wired Glass: Type II (patterned and wired glass, flat), Class 1 (translucent), Quality q8 (glazing); complying with ANSI Z97.1; 1/4" thick; of form and mesh pattern indicated below.
- C. Polished Wire Glass: Form 1 (wired, polished both sides), Mesh m1 (diamond).
- D. Insulating Glass: Composite 1" glazing meeting requirements of Item 2.3A and 2.4A.
- E. Opaque Spandrel glazing shall meet the requirements of 2.3A and 2.4A.

2.4 HEAT-TREATED GLASS PRODUCTS

- A. Coated Tinted Heat Treated Float Glass: Condition C (other coated glass), Type I (transparent glass, flat), Class 2 (tinted heat absorbing and light reducing), Quality q3 (glazing select), with coating type and performance characteristics complying with requirements specified under coated glass products; kind as indicated below:

- 1. Kind FT (fully tempered) where required.

2.5 GLAZING GASKETS

- A. Lock-Strip Gaskets: Neoprene extrusions of size and shape indicated, fabricated into frames with molded corner units and zipper lock strips, complying with ASTM C542; black.
- B. Dense Elastomeric Compression Seal Gaskets: Molded or extruded gaskets of material

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

indicated below, complying with ASTM C 864, of profile and hardness required to maintain watertight seal:

1. EPDM.
- C. Cellular Elastomeric Preformed Gaskets: Extruded or molded closed cell, integral-skinned neoprene of profile and hardness required to maintain watertight seal; complying with ASTM C509, Type II; black.

2.6 MISCELLANEOUS GLAZING MATERIALS

- A. Compatibility: Provide materials with proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Neoprene, EPDM or silicone blocks as required for compatibility with glazing sealants, 80 to 90 Shore A durometer hardness.
- D. Spacers: Neoprene, EPDM or silicone blocks, or continuous extrusions, as required for compatibility with glazing sealant, of size, shape and hardness recommended by glass and sealant manufacturers for application indicated.
- E. Edge Blocks: Neoprene, EPDM or silicone blocks as required for compatibility with glazing sealant, of size and hardness required to limit lateral movement (side-walking) of glass.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Require Glazier to inspect work of glass framing erector for compliance with manufacturing and installation tolerances, including those for size, squareness, offsets at corners; for presence and functioning of weep system; for existence of minimum required face or edge clearances; and for effective sealing of joinery. Obtain Glazier's written report listing conditions detrimental to performance of glazing work. Do not allow glazing work to proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to substrates. Remove lacquer from metal surfaces where elastomeric sealants are indicated for use.

3.3 GLAZING, GENERAL

- A. Comply with combined printed recommendations of glass manufacturers, of manufacturers of sealants, gaskets and other glazing materials, except where more stringent requirements are indicated, including those of referenced glazing standards.
- B. Glazing channel dimensions are required to provide for necessary bite on glass, minimum edge and face clearances, and adequate sealant thickness, with reasonable tolerances. Adjust as required by job conditions at time of installation.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- C. Protect glass from edge damage during handling and installation; use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass with flares or bevels along one horizontal edge which would occur in vicinity of setting blocks so that these are located at top of opening. Remove from project and dispose of glass units with edge damage or other imperfections of kind that, when installed, weakens glass and impairs performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

3.4 GLAZING

- A. Install setting blocks of proper size in sill rabbet, located one quarter of glass width from each corner, but with edge nearest corner not closer than 6" from corner unless otherwise required. Set blocks in thin course of sealant which is acceptable for heel bead use.
- B. Provide spacers inside and out, of correct size and spacing to preserve required face clearances, for glass sizes larger than 50 united inches (length plus height), except where gaskets or glazing tapes with continuous spacer rods are used for glazing. Provide _" minimum bite of spacers on glass and use thickness equal to sealant width, except with sealant tape use thickness slightly less than final compressed thickness of tape.
- C. Provide edge blocking to comply with requirements of referenced glazing standard, except where otherwise required by glass unit manufacturer.
- D. Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.
- E. Provide compressible filler rods or equivalent back-up material, as recommended by sealant and glass manufacturers, to prevent sealant from extruding into glass channel weep systems and from adhering to joints back surface as well as to control depth of sealant for optimum performance, unless otherwise indicated.
- F. Force sealants into glazing channels to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.
- G. Tool exposed surfaces of sealants to provide a substantial "wash" away from glass. Install pressurized tapes and gaskets to protrude slightly out of channel, so as to eliminate dirt and moisture pockets.
- H. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage to ensure that gasket will not "walk" out when installation is subjected to movement.
- I. Miter cut wedge-shaped gaskets at corners and install gaskets in manner recommended by gasket manufacturer to prevent pull away at corners; seal corner joints and butt joints with sealant recommended by gaskets manufacturer.

3.5 PROTECTING AND CLEANING

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Protect exterior glass from breakage immediately upon installation by use of crossed streamers attached to framing and held away from glass. Do not apply markers to surfaces of glass. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove immediately by method recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less often than once a month, for build-up of dirt, scum, alkali deposits or staining. When examination reveals presence of these forms of residue, remove by method recommended by glass manufacturer.
- D. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.
- E. Wash glass on both faces not more than 4 days prior to date scheduled for inspections intended to establish date of substantial completion in each area of project. Wash glass by method recommended by glass manufacturer.

END OF SECTION 08 80 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 9: FINISHES
Section 09 21 16: Gypsum Board Assemblies

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Non-load-bearing steel framing members for gypsum board assemblies.
 - 2. Gypsum board assemblies attached to steel framing.
 - 3. Steel security mesh for secure installation. (Security Gyp. Board)
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 5 Section "Cold-Formed Metal Framing" for load-bearing steel framing.
 - 2. Division 6 Section "Rough Carpentry" for the following:
 - a. Fire-retardant blocking and furring.
 - b. Water-resistant gypsum sheathing.
 - 3. Division 7 Sections 07412 "Manufactured Prefinished Horizontal Corrugated Wall Panels" and 07414 "Manufactured Prefinished Vertical Smoothline Wall Panels".
 - 4. Division 7 Section "Firestopping" for firestopping systems and fire-resistive-rated joint sealants.
 - 5. Division 9 Section "Tile" for cementitious backer units installed as substrates for ceramic tile.

1.3 DEFINITIONS

- A. Gypsum Board Construction Terminology: Refer to ASTM C 11 and GA-505 for definitions of terms related to gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 SUBMITTALS

- A. General: Submit the following according to General Contractor Conditions of the Contract.
- B. Product data for each type of product specified.
- C. Product certificates signed by manufacturers of gypsum board assembly components certifying that their products comply with specified requirements.

1.5 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Where fire-rated gypsum board assemblies are indicated,

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire Resistance Ratings: As indicated by reference to GA File Numbers in GA-600 "Fire Resistance Design Manual" or to design designations in UL "Fire Resistance Directory" or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Single-Source Responsibility for Steel Framing: Obtain steel framing members for gypsum board assemblies from a single manufacturer.
- C. Single-Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.
- D. Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.
- E. Field Samples: On actual gypsum board assemblies, prepare field samples of at least 100 sq. ft. in surface area for the following applications. Simulate finished lighting conditions for review of in-place unit of Work.
 1. Wall surfaces indicated to receive nontextured paint finishes.
 2. Ceiling surfaces indicated to receive nontextured paint finishes.
 3. Surfaces indicated to receive textured finishes specified in this Section.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum panels flat to prevent sagging.
- C. Handle gypsum board to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner beads and trim.

1.7 PROJECT CONDITIONS

- A. Environmental Conditions, General: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 and with gypsum board manufacturer's recommendations.
- B. Room Temperatures: For non adhesive attachment of gypsum board to framing, maintain not less than 40 deg F (4 deg C). For adhesive attachment and finishing of gypsum board, maintain not less than 50 deg F (10 deg C) for 48 hours prior to application and continuously after until dry. Do not exceed 95 deg F (35 deg C) when using temporary heat sources.
- C. Ventilation: Ventilate building spaces, as required, for drying joint treatment materials. Avoid drafts during hot dry weather to prevent finishing materials from drying too rapidly.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
1. Steel Framing and Furring:
 - a. Alabama Metal Industries Corp.
 - b. Dietrich Industries, Inc.
 - c. Gold Bond Building Products Div., National Gypsum Co.
 2. Grid Suspension Assemblies:
 - a. Chicago Metallic Corp.
 - b. National Rolling Mills Co.
 - c. USG Interiors, Inc.
 3. Gypsum Board and Related Products:
 - a. Georgia-Pacific Corp.
 - b. Gold Bond Building Products Div., National Gypsum Co.
 - c. United States Gypsum Co.
 4. Fiberglass Reinforced Concrete Panels and Columns
 - a. Creative Architectural Castings.
 - b. Plastrglas, Inc.

2.2 STEEL FRAMING COMPONENTS FOR SUSPENDED AND FURRED CEILINGS

- A. General: Provide components complying with ASTM C 754 for materials and sizes unless otherwise indicated.
- B. Cast-In-Place and Postinstalled Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials, with holes or loops for attaching hanger wires, and with capability to sustain, without failure, a load equal to 5 times that imposed by ceiling construction, as determined from testing per ASTM E 488 conducted by a qualified independent testing agency.
1. Cast-in-place type designed for attachment to concrete forms.
 2. Chemical anchor.
 3. Expansion anchor.
- C. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
- D. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- E. Hanger Rods: Mild steel and zinc-coated or protected with rust-inhibitive paint.
- F. Flat Hangers: Mild steel and zinc-coated or protected with rust-inhibitive paint.
- G. Angle-Type Hangers: Angles with legs not less than 7/8 inch wide, formed from 0.0635-inch-thick galvanized steel sheet complying with ASTM A 446 Coating Designation G90, with bolted connections and 5/16-inch-diameter bolts.
- H. Channels: Cold-rolled steel, 0.05980-inch-minimum thickness of base (uncoated) metal and 7/16-inch-wide flanges, and as follows:
 - 1. Carrying Channels: 2 inches deep, 590 lb per 1000 feet, unless otherwise indicated.
 - 2. Carrying Channels: 1-1/2 inch deep, 475 lb per 1000 feet, unless otherwise indicated.
 - 3. Furring Channels: 3/4 inch deep, 300 lb per 1000 feet, unless otherwise indicated.
 - 4. Finish: Rust-inhibitive paint, unless otherwise indicated.
 - 5. Finish: G-60 hot-dip galvanized coating per ASTM A 525 for framing for exterior soffits and where indicated.
- I. Steel Studs for Furring Channels: ASTM C 645, with flange edges bent back 90 deg and doubled over to form 3/16-inch minimum lip (return), minimum thickness of base (uncoated) metal and minimum depth as follows:
 - 1. Thickness: As indicated.
 - 2. Depth: As indicated.
 - 3. Protective Coating: Manufacturer's standard corrosion-resistant coating.
- J. Steel Rigid Furring Channels: ASTM C 645, hat-shaped, depth of 7/8 inch, and minimum thickness of base (uncoated) metal as follows:
 - 1. Thickness: As indicated.
 - 2. Protective Coating: Manufacturer's standard corrosion-resistant coating.
- K. Grid Suspension System for Interior Ceilings: ASTM C 645, manufacturer's standard direct-hung grid suspension system composed of main beams and cross furring members that interlock to form a modular supporting network.

2.3 STEEL FRAMING FOR WALLS AND PARTITIONS

- A. General: Provide steel framing members complying with the following requirements:
 - 1. Component Sizes and Spacings: As indicated but not less than that required to comply with ASTM C 754 under the following maximum deflection and lateral loading conditions:
 - a. Maximum Deflection: L/240 at 5 lbf per sq. ft.
 - 2. Protective Coating: Manufacturers standard corrosion-resistant coating.
- B. Steel Studs and Runners: ASTM C 645, with flange edges of studs bent back 90 deg and doubled over to form 3/16-inch-wide minimum lip (return) and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Thickness: 0.0179 inch, unless otherwise indicated.
 2. Depth: As indicated.
- C. Steel Rigid Furring Channels: ASTM C 645, hat-shaped, depth and minimum thickness of base (uncoated) metal as follows:
1. Depth: 7/8 inch.
 2. Thickness: 0.0179 inch, unless otherwise indicated.
- D. Furring Brackets: Serrated-arm type, adjustable, fabricated from corrosion-resistant steel sheet complying with ASTM C 645, minimum thickness of base (uncoated) metal of 0.0329 inch, designed for screw attachment to steel studs and steel rigid furring channels used for furring.
- E. Z-Furring Members: Manufacturer's standard Z-shaped furring members with slotted or nonslotted web, fabricated from steel sheet complying with ASTM A 525 or ASTM A 568; with a minimum base metal (uncoated) thickness of 0.0179 inch, face flange of 1-1/4 inch, wall-attachment flange of 7/8 inch, and of depth required to fit insulation thickness indicated.
- F. Fasteners for Metal Framing: Provide fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated.

2.4 GYPSUM BOARD PRODUCTS

- A General: Provide gypsum board of types indicated in maximum lengths available to minimize end-to-end butt joints.
1. Thickness: Provide gypsum board in thicknesses indicated or, if not otherwise indicated, in either 1/2 inch, 5/8 inch or 3/4 inch thicknesses to comply with ASTM C 840 for application system and support spacing indicated.
- B. Gypsum Wallboard: ASTM C 36 and as follows:
1. Type: Regular for vertical surfaces, unless otherwise indicated.
 2. Type: Type X where required for fire-resistive-rated assemblies.
 3. Type: Sag-resistant type for ceiling surfaces.
 4. Edges: Tapered.
 5. Thickness: As indicated.
 6. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work where proprietary gypsum wallboard is indicated include, but are not limited to, the following:
 - a. Gyprock Fireguard C Gypsum Board, Domtar Gypsum.
 - b. Firestop Type C, Georgia-Pacific Corp.
 - c. Fire-Shield G, Gold Bond Building Products Div., National Gypsum Co.
 - d. SHEETROCK Brand Gypsum Panels, FIRECODE Core, United States Gypsum Co.
 - e. SHEETROCK Brand Gypsum Panels, ULTRACODE Core, United States Gypsum Co.
- C. Gypsum Backing Board for Multilayer Applications: ASTM C 442 or, where backing board is not available from manufacturer, gypsum wallboard, ASTM C 36 and as follows:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Type: Regular for vertical surfaces, unless otherwise indicated.
 2. Type: Type X where indicated or required for fire-resistive-rated assemblies.
 3. Type: Sag-resistant type for ceiling surfaces, unless otherwise indicated.
 4. Edges: Manufacturer's standard.
 5. Thickness: As indicated.
- D. Security Gypsum Board Ceiling and walls shall be (2) layers 5/8" FR board on conventional suspension system or studs with one (1) layer carbon steel security mesh ASM 1.5-16F in-between layers of gypsum board. Optional system shall be a high impact fire-shield wallboard 5/8" thick with GE Lexan substrate meeting ASTM C36/C1396 type X equal to National Gypsum or U.S. Gypsum.

2.5 TRIM ACCESSORIES

- A. Accessories for Interior Installation: Corner beads, edge trim, and control joints complying with ASTM C 1047 and requirements indicated below:
1. Material: Formed metal, plastic, or metal combined with paper, with metal complying with the following requirement:
 - a. Sheet steel zinc-coated by hot-dip process.
 2. Shapes indicated below by reference to Fig. 1 designations in ASTM C 1047:
 - a. Cornerbead on outside corners, unless otherwise indicated.
 - b. LC-bead with both face and back flanges; face flange formed to receive joint compound. Use LC-beads for edge trim unless otherwise indicated.
 - c. L-bead with face flange only; face flange formed to receive joint compound. Use L-bead where indicated.
 - d. One-piece control joint formed with V-shaped slot, with removable strip covering slot opening.

2.6 JOINT TREATMENT MATERIALS

- A. General: Provide joint treatment materials complying with ASTM C 475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.
- B. Joint Tape for Gypsum Board: Paper reinforcing tape, unless otherwise indicated.
1. Use pressure-sensitive or staple-attached open-weave glass-fiber reinforcing tape with compatible joint compound where recommended by manufacturer of gypsum board and joint treatment materials for application indicated.
- C. Setting-Type Joint Compounds for Gypsum Board: Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.
1. Where setting-type joint compounds are indicated as a taping compound only or for taping and filling only, use formulation that is compatible with other joint compounds applied over it.
 2. For prefiling gypsum board joints, use formulation recommended by gypsum board

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- manufacturer for this purpose.
- 3. For filling joints and treating fasteners of water-resistant gypsum backing board behind base for ceramic tile, use formulation recommended by the gypsum board manufacturer for this purpose.
- 4. For topping compound, use sandable formulation.

2.7 MISCELLANEOUS MATERIALS

- A. General: Provide auxiliary materials for gypsum board construction that comply with referenced standards and recommendations of gypsum board manufacturer.
- B. Laminating Adhesive: Special adhesive or joint compound recommended for laminating gypsum panels.
- C. Spot Grout: ASTM C 475, setting-type joint compound recommended for spot grouting hollow metal door frames.
- D. Fastening Adhesive for Wood: ASTM C 557.
- E. Fastening Adhesive for Metal: Special adhesive recommended for laminating gypsum panels to steel framing.
- F. Steel drill screws complying with ASTM C 1002 for the following applications:
 - 1. Fastening gypsum board to steel members less than 0.03 inch thick.
 - 2. Fastening gypsum board to wood members.
 - 3. Fastening gypsum board to gypsum board.
- G. Steel drill screws complying with ASTM C 954 for fastening gypsum board to steel members from 0.033 to 0.112 inch thick.
- H. Corrosion-resistant-coated steel drill screws of size and type recommended by board manufacturer for fastening cementitious backer units.
- I. Gypsum Board Nails: ASTM C 514.
- J. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, cast-in-anchors, and structural framing with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Ceiling Anchorages: Coordinate installation of ceiling suspension systems with installation of

overhead structural assemblies to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers that will develop their full strength and at spacing required to support ceilings.

1. Furnish concrete inserts and other devices indicated to other trades for installation well in advance of time needed for coordination with other construction.

3.3 INSTALLING STEEL FRAMING, GENERAL

- A. Steel Framing Installation Standard: Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.
- B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with recommendations of gypsum board manufacturer or, if none available, with "Gypsum Construction Handbook" published by United States Gypsum Co.
- C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement. Comply with details shown on Drawings.
 1. Where building structure abuts ceiling perimeter or penetrates ceiling.
 2. Where partition framing and wall furring abut structure except at floor.
 - a. Provide slip- or cushioned-type joints as detailed to attain lateral support and avoid axial loading.
- D. Do not bridge building expansion and control joints with steel framing or furring members. Independently frame both sides of joints with framing or furring members as indicated.

3.4 INSTALLING STEEL FRAMING FOR SUSPENDED AND FURRED CEILINGS

- A. Suspend ceiling hangers from building structural members and as follows:
 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
 3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 4. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for structure as well as for type of hanger involved, and in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

5. Do not support ceilings directly from permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 6. Do not attach hangers to steel deck tabs.
 7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 8. Do not connect or suspend steel framing from ducts, pipes or conduit.
- B. Sway-brace suspended steel framing with hangers used for support.
- C. Install suspended steel framing components in sizes and at spacings indicated but not less than that required by the referenced steel framing installation standard.
1. Wire Hangers: 0.1620-inch (8-gage) diameter, 4 feet o.c.
 2. Carrying Channels (Main Runners): 1-1/2 inch, 4 feet o.c.
 3. Rigid Furring Channels (Furring Members): 16 inches o.c.
 4. Rigid Furring Channels (Furring Members): 24 inches o.c.
- D. Installation Tolerances: Install steel framing components for suspended ceilings so that cross-furring members or grid suspension members are level to within 1/8 inch in 12 feet as measured both lengthwise on each member and transversely between parallel members.
- E. Wire-tie or clip furring members to main runners and to other structural supports as indicated.
- F. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.5 INSTALLING STEEL FRAMING FOR WALLS AND PARTITIONS

- A. Install runners (tracks) at floors, ceilings, and structural walls and columns where gypsum board stud assemblies abut other construction.
1. Where studs are installed directly against exterior walls, install asphalt felt strips between studs and wall.
- B. Installation Tolerances: Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8 inch from the plane formed by the faces of adjacent framing.
- C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Cut studs 1/2 inch short of full height. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
1. For STC-rated and fire-resistive-rated partitions requiring partitions to extend to the underside of floor/roof slabs and decks or other continuous solid structural surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed, to support gypsum board closures needed to make partitions continuous from floor to underside of solid structure.
- D. Terminate partition framing at suspended ceilings only where indicated.
- E. Install steel studs and furring in sizes and at spacings indicated but not less than that required by the referenced steel framing installation standard to comply with maximum deflection and

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

minimum loading requirements specified:

1. Single-Layer Construction: Space studs at 16 inches o.c.
 2. Single-Layer Construction: Space studs at 24 inches o.c.
 3. Single- and Double-Layer Construction: Space studs at 24 inches o.c.
 4. Install all metal panel systems where shown on drawings on 16 gauge steel studs at 32" o.c.
- F. Install steel studs so that flanges point in the same direction and so that leading edges or ends of each gypsum board can be attached to open (unsupported) edges of stud flanges first.
- G. Frame door openings to comply with details indicated, with GA-219, and with applicable published recommendations of gypsum board manufacturer. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
1. Extend vertical jamb studs through suspended ceilings and attach to underside of floor or roof structure above.
- H. Frame openings other than door openings to comply with details indicated or, if none indicated, in same manner as required for door openings. Install framing below sills of openings to match framing required above door heads.
- I. Install thermal insulation as follows:
1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches o.c.
 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw attach short flange of furring channel to web of attached channel. Start from this furring channel with standard width insulation panel and continue in regular manner. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
 4. Until gypsum board is installed, hold insulation in place with 10-inch staples fabricated from 0.0625-inch (16-gage)-diameter tie wire and inserted through slot in web of member.

3.6 APPLYING AND FINISHING GYPSUM BOARD, GENERAL

- A. Gypsum Board Application and Finishing Standards: Install and finish gypsum panels to comply with ASTM C 840 and GA-216.
- B. Install ceiling board panels across framing to minimize the number of abutting end joints and avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install wall/partition board panels to minimize the number of abutting end joints or avoid them entirely. Stagger abutting end joints not less than one framing member in alternate courses of board. At stairwells and other high walls, install panels horizontally with end abutting joints over studs and staggered.
- D. Install gypsum panels with face side out. Do not install imperfect, damaged, or damp panels. Butt

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

- E. Locate both edge or end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Position adjoining panels so that tapered edges abut tapered edges, and field-cut edges abut field-cut edges and ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions. Avoid joints at corners of framed openings where possible.
- F. Attach gypsum panels to steel studs so that the leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- G. Attach gypsum panels to framing provided at openings and cutouts.
- H. Do not attach gypsum panels across the flat grain of wide-dimension lumber including floor joists and headers. Instead, float gypsum panels over these members using resilient channels or provide control joints to counteract wood shrinkage.
- I. Spot grout hollow metal door frames for solid core wood doors, hollow metal doors, and doors over 32 inches wide. Apply spot grout at each jamb anchor clip and immediately insert gypsum panels into frames.
- J. Form control joints and expansion joints at locations indicated and as detailed, with space between edges of adjoining gypsum panels, as well as supporting framing behind gypsum panels.
- K. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chase walls that are braced internally.
 - 1. Except where concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4-to-1/2-inch-wide joints to install sealant.
- L. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors, as detailed. Provide 1/4-inch-to-1/2-inch-wide spaces at these locations and trim edges with finishing bead where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- M. Floating Construction: Where feasible, including where recommended by manufacturer, install gypsum panels over wood framing, with floating internal corner construction.
- N. Where STC-rated gypsum board assemblies are indicated, seal construction at perimeters, behind control and expansion joints, openings, and penetrations with a continuous bead of acoustical sealant including a bead at both faces of the partitions. Comply with ASTM C 919 and manufacturer's recommendations for location of edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.
- O. Space fasteners in gypsum panels according to referenced gypsum board application and

finishing standard and manufacturer's recommendations.

3.7 GYPSUM BOARD APPLICATION METHODS

- A. Single-Layer Application: Install gypsum wallboard panels as follows:
1. On ceilings, apply gypsum panels prior to wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
 2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated, and provide panel lengths that will minimize end joints.
 3. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing), unless parallel application is required for fire-resistive-rated assemblies. Use maximum-length panels to minimize end joints.
 4. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
- B. Double-Layer Application: Install gypsum backing board for base layers and gypsum wallboard for face layers.
1. On ceilings, apply base layer prior to applying base layer on walls/partitions; apply face layers in same sequence. Offset face-layer joints at least 10 inches from parallel base-layer joints. Apply base layers at right angles to framing members unless otherwise indicated.
 2. On partitions/walls, apply base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face layer joints offset at least one stud or furring member with base layer joints. Stagger joints on opposite sides of partitions.
 3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
- C. Acoustical Tile Base: Where gypsum panels form the base for adhesively applied acoustical tile, install gypsum wallboard panels.
- D. Single-Layer Fastening Methods: Apply gypsum panels to supports as follows:
1. Fasten with screws.
- E. Double-Layer Fastening Methods: Apply base layer of gypsum panels and face layer to base layer as follows:
1. Fasten both base layers and face layers separately to supports with screws.
- F. Direct-Bonding to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members or base layer of gypsum board), comply with gypsum board manufacturer's recommendations, and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.8 INSTALLING TRIM ACCESSORIES

- A. General: For trim accessories with back flanges, fasten to framing with the same fasteners used to fasten gypsum board. Otherwise, fasten trim accessories according to accessory

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

manufacturer's directions for type, length, and spacing of fasteners.

- B. Install corner beads at external corners.
- C. Install edge trim where edge of gypsum panels would otherwise be exposed or semiexposed. Provide edge trim type with face flange formed to receive joint compound except where other types are indicated.
 - 1. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
 - 2. Install L-bead where edge trims can only be installed after gypsum panels are installed.
 - 3. Install aluminum edge trim and other accessories where indicated.
- D. Install control joints at locations indicated, and where not indicated according to ASTM C 840, and in locations approved by Architect for visual effect at door openings and walls over 20' long.
- E. Install H-molding in exterior gypsum board assemblies where control joints are indicated. Install on cut or ends of gypsum panels, not on tapered edges.

3.9 FINISHING GYPSUM BOARD ASSEMBLIES

- A. General: Apply joint treatment at gypsum board joints (both directions); flanges of corner bead, edge trim, and control joints; penetrations; fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration and levels of gypsum board finish indicated.
- B. Prefill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.
- C. Apply joint tape over gypsum board joints except those with trim accessories having concealed face flanges not requiring taping to prevent cracks from developing in joint treatment at flange edges.
- D. Apply joint tape over gypsum board joints and to trim accessories with concealed face flanges as recommended by trim accessory manufacturer and as required to prevent cracks from developing in joint compound at flange edges.
- E. Finish glass-mat water-resistant gypsum backing board to comply with board manufacturer's directions.

3.10 CLEANING AND PROTECTION

- A. Promptly remove any residual joint compound from adjacent surfaces.
- B. Provide final protection and maintain conditions, in a manner suitable to Installer, that ensures gypsum board assemblies remain without damage or deterioration at time of Substantial Completion.

END OF SECTION 09 21 16

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 9
Section 09 23 00

FINISHES
Seamless Wall / Floor Surface for Shower Floors and Walls

1 GENERAL

Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section.

1.1 DESCRIPTION

A. Work described in this section includes supply and installation of fiberglass reinforced epoxy wall/ floor coating system.

1.2 SUBMITTALS

A. Product Data – Submit manufacturer’s most current literature describing material, physical properties and performance criteria.

B. Samples: Submit manufacturer’s full line of color samples for selection. After selection of color and texture, submit samples for each color.

C. Submit layout drawing allowing color and stripping layout.

2.1 PRODUCTS

A. Composition “seamless” wallcovering shall be a fiberglass mat reinforced, 100% solids, thermosetting epoxy system.

B. The STRANLOCK MICRO CLEAN SYSTEM from Tnemec Company is specified to establish the desired quality and performance of the work.

Technical Information may be obtained from the following:

SteelCon Coating Systems
2100 3rd Ave South
Irondale, AL 35210
Phone: 205-951-2086
E Mail: dparnell@tnemec.com
rcrumbaugh@tnemec.com

C. Color or colors and texture shall be selected from the manufacturer’s standard range.

D. Finish color and texture shall match approved sample(s).

3.1 ACCESSORIES

A. Fiberglass fabric per recommendations of the coating manufacturer.

B. Non-shrinking water putty for rolled radius coves.

C. Base, screed strips per manufacturer’s recommendations.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

D. Manufacturer's standard 100% solids by volume system on concrete masonry unit partitions.

E. Manufacturer's standard epoxy matrix and grout coat materials.

4.0 COATINGS AND MATERIALS

4.1 INSTALLATION

A. Seamless wallcovering shall be by an applicator approved by the manufacturer.

B. Prepare and treat the substrate in accordance with the manufacturer's instructions.

C. Where resurfacing, leveling or patching is required use Tnemec Series 218 MortarClad or Series 215 Surfacing Epoxy.

D. Install 100% epoxy matrix coating per manufacturer's recommendations. Imbed recommended fiberglass fabric as directed and finish coat(s) to match approved sample for color, texture, sheen, etc.

E. Apply foundation grout coats, parge coats, and finish coats in accordance with the manufacturer's instructions to match thickness at base.

F. **CMU Block:** All surfaces must be clean, moisture free, physically sound and free of all grease, oil, dirt or any foreign materials or contaminants that will interfere with primer adhesion and/ or penetration.

G. Overlap finish onto any trowelled type base shall be minimum of ½ inch.

H. Allow entire system to cure and protect areas from traffic for a minimum of seven (7) days.

I. Where coating terminates onto flat surface of wall or ceiling, finish edge shall be a bullnose with no exposed mesh.

4.2 SEAMLESS WALL SYSTEM

A. The following Tnemec products are to be used:

1. Series 215 Surfacing Epoxy
2. Series 273 Stranlok ML
3. Series 280 Tneme-Glaze
4. Series 297 Enviro-glaze

B. Coating System:

1. Bedding Coat: Tnemec Series 215 Surfacing Epoxy shall be mechanically mixed and applied in accordance with manufacturer's instructions. Materials shall be applied at a nominal 1/16" or 25 square feet per gallon.
2. Reinforcing Mat: Tnemec Series 273 fiberglass reinforcing mat shall be precut and immediately placed into the wet bedding material. Smooth over the fiberglass mat using a trowel or broad knife to completely embed the mat and

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

remove any air pockets. When forming a seam with two pieces of glass mat it is important to create a "butt-joint" ,do **not** overlap the fiberglass glass mat.

3. Saturant Coat: Tnemec Series 273 Stranlok ML shall be mechanically mixed in accordance with manufacturer's instructions and applied by roller at a dry film thickness of 6.0 to 8.0 mils to completely and uniformly saturate the fiberglass reinforcing mat. Before topcoating the surface should be pole sanded to smooth surface and remove all protruding fibers.
4. Intermediate Coat: Tnemec Series 280 Tneme-Glaze shall be mechanically mixed and applied in accordance with manufacturer's printed instructions at a dry film thickness of 6.0 - 8.0 mils.
5. Finish: Tnemec Series 297 Enviro-Glaze shall be mechanically mixed and applied in accordance with manufacturer's printed instructions at a dry film thickness of 2.0 - 3.0 mils.

END OF SECTION 09 23 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 9: FINISHES
Section 09 51 13:Acoustical Panel Ceiling

PART I - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and any general provisions of the Contract for each Prime Contract, including General and Supplementary Conditions and specific requirements apply to this Section.

1.2 SUMMARY

- A. This Section includes:
1. Lay-in type acoustical panel ceilings installed with exposed suspension systems.
 2. Surface mounted 24" x 24" tectum acoustical ceiling panels and wall panels where shown on drawings.
- B. Related Sections: The following sections contain requirements that relate to this section:
1. Division 15 Section "Fire Protection" for sprinkler heads in acoustical ceilings.
 2. Division 15 Section "Air Outlets and Inlets" for grilles, registers, and diffusers in acoustical ceilings.
 3. Division 16 Section "Interior Lighting Fixtures" for lighting fixtures in acoustical ceilings.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract.
1. Product data for each type of product specified.
 2. Samples for initial selection purposes in form of manufacturer's color charts consisting of actual acoustical units or sections of units showing full range of colors, textures, and patterns available for each type of unit indicated.
 3. Samples for verification purposes of each type of exposed finish required, prepared on samples of size indicated below and of same thickness and material indicated for final unit of Work. Where finishes involve normal color and texture variations, include sample sets showing full range of variations expected.
 1. 6-inch-square samples of each acoustical panel type, pattern, and color.
 2. Set of 12-inch-long samples of exposed suspension system members, including moldings, for each color and system type required.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has successfully completed acoustical ceilings similar in material, design, and extent to those indicated for Project.
- B. Fire-Performance Characteristics: Provide acoustical ceilings that are identical to those tested for the following fire-performance characteristics, per ASTM test method indicated below, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify acoustical ceiling components with appropriate markings of applicable

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

testing and inspecting organization.

1. Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 for Class A products.
 - a. Flame Spread: 25 or less.
 - b. Smoke Developed: 50 or less.
 2. Fire-Resistance Ratings: As indicated by reference to design designations in UL "Fire Resistance Directory," for types of assemblies in which acoustical ceilings function as a fire- protective membrane and tested per ASTM E 119.
 - a. Protect lighting fixtures and air ducts to comply with requirements indicated for rated assembly.
- C. Single-Source Responsibility for Ceiling Units: Obtain each type of acoustical ceiling unit from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.
- D. Single-Source Responsibility for Suspension System: Obtain each type of suspension system from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.
1. Obtain suspension system from same manufacturer that produces acoustical ceiling units.
- E. Coordination of Work: Coordinate layout and installation of acoustical ceiling units and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system components (if any), and partition system (if any).

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical ceiling units carefully to avoid chipping edges or damaging units in any way.

1.6 PROJECT CONDITIONS

- A. Space Enclosure: Do not install interior acoustical ceilings until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

1.7 EXTRA MATERIALS

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Deliver extra materials to Owner. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with appropriate labels.
 - 1. Acoustical Ceiling Units: Furnish quantity of full-size units equal to 2.0 percent of amount installed.
 - 2. Exposed Suspension System Components: Furnish quantity of each exposed component equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:
 - 1. Mineral Base Panels - Water Felted, with Painted Finish and Perforated and Fissured Pattern, Non-Fire-Resistance Rated:
 - a. "Fine Fissured RH90," Armstrong World Industries, Inc.
 - b. "Hytone Baroque," Celotex Corp.
 - c. "Auratone Natural Fissured II," USG Interiors, Inc.
- C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Non-Fire-Resistance-Rated Wide-Face Double-Web Steel Suspension Systems:
 - a. Armstrong World Industries, Inc.
 - b. Chicago Metallic Corporation.
 - c. National Rolling Mills, Inc.
 - d. USG Interiors, Inc.

2.2 ACOUSTICAL CEILING UNITS, GENERAL

- A. Standard for Acoustical Ceiling Units: Provide manufacturers' standard units of configuration indicated that comply with ASTM E 1264 classifications as designated by reference to types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
 - 1. Mounting Method for Measuring NRC: Type E-400 (plenum mounting in which face of test specimen is 15-3/4 inches [400 mm] away from the test surface) per ASTM E 795.

2.3 MINERAL-BASE ACOUSTICAL PANELS - NODULAR, CAST OR MOLDED

- A. Type, Form, and Finish: Provide Type III, Form 1 units per ASTM E 1264 with painted finish that comply with pattern and other requirements indicated.
- B. Fine Fissured Pattern: Units fitting ASTM E 1264 pattern designation CE, with other characteristics as follows:
 - 1. Color/Light Reflectance Coefficient: White/LR Min. 0.80.
 - 2. Noise Reduction Coefficient: NRC 0.55.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Edge Detail: Square-Cut Lay-In.
5. Size: 24 inches by 24 inches by 5/8 inch.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

- A. Standard for Metal Suspension Systems: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.
- B. Finishes and Colors: Provide manufacturer's standard factory-applied finish for type of system indicated.
- C. Attachment Devices: Size for 5 times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.
 1. Cast-In-Place and Postinstalled Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials, with holes or loops for attachment of hangers of type indicated and with capability to sustain, without failure, a load equal to 5 times that imposed by ceiling construction, as determined by testing per ASTM E 488, conducted by a qualified independent testing laboratory.
 - a. Cast-in-place anchors.
 - b. Expansion anchors.
 2. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attachment of hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing laboratory.
- D. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.
 1. Gage: Provide wire sized so that stress at 3 times hanger design load (ASTM C 635, Table 1, Direct-Hung), will be less than yield stress of wire, but provide not less than 0.106-inch diameter (12 gage).
- E. Hanger Rods: Mild steel, zinc coated, or protected with rust-inhibitive paint.
- F. Flat Hangers: Mild steel, zinc coated, or protected with rust-inhibitive paint.
- G. Angle Hangers: Angles with legs not less than 7/8 inch wide, formed with 0.0365-inch-thick galvanized steel sheet complying with ASTM A 446, Coating Designation G90, with bolted connections and 5/16-inch-diameter bolts.
- H. Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit type of edge detail and suspension system indicated.
 1. For lay-in panels with tegular edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and

flange at exposed suspension member.

2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.5 NON-FIRE-RESISTANCE-RATED DIRECT-HUNG SUSPENSION SYSTEMS

- A. Wide-Face Capped Double-Web Steel Suspension System: Main and cross-runners roll-formed from prepainted or electrolytic zinc-coated cold-rolled steel sheet, with prefinished 15/16-inch-wide metal caps on flanges; other characteristics as follows:
 1. Structural Classification: Intermediate-Duty System.
 2. End Condition of Cross-Runners: Override (stepped) or butt-edge type, as standard with manufacturer.
 3. Cap Material and Finish: Steel sheet painted white.

2.6 ACOUSTICAL CEILING AND WALL PANELS

- A. Surface-mounted acoustical ceiling and wall panels shall be equal to Tectum Inc. 24" x 24" x 1½" (or as shown on drawings) with direct attachment to concrete ceiling or wall surfaces utilizing color matching Tapcon screws spaced per manufacturer's instructions. Panels shall be painted white with Bev/Bev square ends. Edges and exposed face shall be fully finished.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and structural framing to which ceiling system attaches or abuts, with Installer present, for compliance with requirements specified in this and other sections that affect installation and anchorage of ceiling system. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.
 1. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.
- B. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half-width units at borders, and comply with reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install acoustical ceiling systems to comply with installation standard referenced below, per manufacturer's instructions and CISCA "Ceiling Systems Handbook."
 1. Standard for Installation of Ceiling Suspension Systems: Comply with ASTM C

636.

- B. Arrange acoustical units and orient directionally patterned units in a manner shown by reflected ceiling plans.
- C. Suspend ceiling hangers from building structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
 - 3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 4. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, or other devices that are secure and appropriate for structure to which hangers are attached as well as for type of hanger involved, and in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 - 5. Do not support ceilings directly from permanent metal forms; furnish cast-in-place hanger inserts that extend through forms.
 - 6. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 7. Space hangers not more than 4'-0" o.c. along each member supported directly from hangers, unless otherwise shown, and provide hangers not more than 8 inches from ends of each member.
- D. Install edge moldings of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical units.
 - 1. Screw-attach moldings to substrate at intervals not over 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to tolerance of 1/8 inch in 12'-0". Miter corners accurately and connect securely.
- E. Install acoustical panels in coordination with suspension system, with edges concealed by support of suspension members. Scribe and cut panels to fit accurately at borders and at penetrations.

3.4 CLEANING

- A. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

END OF SECTION 09 51 1

DIVISION 9 **FINISHES**
Section 09 67 16: Epoxy Flooring

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section.

1.2 SUMMARY

- A. This Section includes slip resistant resinous flooring system
 1. Nominal 3/32- to 1/8-inch-thick flooring system with slip resistant surface.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.
- B. Samples for Verification: For each resinous flooring system required, 6 inches (150 mm) square, applied to a rigid backing by Installer for this Project.
- C. Product Schedule: Use resinous flooring designations indicated in Part 2 and room designations indicated on Drawings in product schedule.
- D. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
- E. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. No request for substitution shall be considered that would change the generic type of floor system specified (i.e. urethane-urea based resilient mortar with stain-resistant clear topcoat). Equivalent materials of other manufacturers may be substituted only on approval of Architect or Engineer. Request for substitution will only be considered only if submitted 10 days prior to bid date. Request will be subject to specification requirements described in this section.
- B. Installer Qualifications: Engage an experienced installer who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.
 1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
 2. Contractor shall have completed at least 10 projects of similar size and complexity.
 3. General Contractor will not self perform this work.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- C. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, through one source from a single manufacturer, with not less than ten years of successful experience in manufacturing and installing principal materials described in this section. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.
- D. Manufacturer Field Technical Service Representatives: Resinous flooring manufacture shall retain the services of Field Technical Service Representatives who are trained specifically on installing the system to be used on the project.
 - 1. Field Technical Services Representatives shall be employed by the system manufacture to assist in the quality assurance and quality control process of the installation and shall be available to perform field problem solving issues with the installer.
- E. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Apply full-thickness mockups on 48-inch- (1200-mm-) square floor area selected by Architect.
 - a. Include 48-inch (1200-mm) length of integral cove base.
 - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- F. Pre-installation Conference:
 - 1. General contractor shall arrange a meeting not less than thirty days prior to starting work.
 - 2. Attendance:
 - a. General Contractor
 - b. Architect/Owner's/Construction Manager Representative.
 - c. Manufacturer/Installer's Representative.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.
- B. Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.
- C. All materials used shall be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors. No on site weighing or volumetric measurements allowed.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
 - 1. Maintain material and substrate temperature between 65 and 85 deg F (18 and 30 deg C) during resinous flooring application and for not less than 24 hours after application.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
- C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.
- D. Concrete substrate shall be properly cured for a minimum of 30 days. A vapor barrier must be present for concrete subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring
- E. 1.7 WARRANTY
- A. Manufacturer shall furnish a single, written warranty covering both material and workmanship for a period of one (1) one year from date of installation, or provide a joint and several warranty signed on a single document by material manufacturer and applicator jointly and severally warranting the materials and workmanship for a period of (1) one year from date of installation. A sample warranty letter must be included with submittal package or submittal package will be returned 'revise and resubmit'.

PART 2 - PRODUCTS

2.1 RESINOUS FLOORING

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, the following:
- B. Products: Provide the following:
 - 1. Tnemec Stratashield , Basis of design or approved equivalent.

Technical information may be obtained from the following:

SteelCon Coating Systems, Inc.
2100 3rd Ave South
Irondale, AL 35210
Phone: 205-951-2086
E Mail: dparnell@tnemec.com
rcrumbaugh@tnemec.com

- C. System Characteristics:
 - 1. Color and Pattern: Textured color to be selected from standard colors.
 - 2. Wearing Surface: Textured.
 - 3. Integral Cove Base: 6" height, integral base.
 - 4. Overall System Thickness: 3/32-1/8 inch.
- D. System Components: Manufacturer's standard components that are compatible with each other and as follows:
 - 1. Base Coat & 1st Broadcast:
 - a. Material Basis: Tnemec Series 241 Ultra-Tread MVT @ 70 – 80 square feet per kit. Broadcast to refusal with specified aggregate.
 - b. Number of Coats: One.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Aggregate:
 - a. Material Basis: Tnemec Chromaquartz.
3. 2nd Broadcast:
 - a. Material Basis: Tnemec Series 222 Deco-Tread @ 20 mils (80 square feet per gallon). Broadcast to refusal with specified aggregate.
4. Aggregate:
 - a. Material Basis: Tnemec Chromaquartz.
5. Grout Coat:
 - a. Material Basis: Tnemec Series 222 Deco-Tread @ 8.0 – 12.0 mils (130 – 200 square feet per gallon)
 - b. Number of Coats: two (1).
6. Finish Coat:
 - a. Material Basis: Tnemec Series 248 Everthane @ 2.0 – 3.0 mils.
 - b. Number of Coats: two (1).

2.2 ACCESSORY MATERIALS

- A. Floor Strips: Use kind and type recommended by manufacturer, and compatible with floor products listed. Use strips for termination of floor and division of colors and patterns. See floor finish plan for location and patterns. Consult manufacturer's product installation data for strip dimensions.
- B. Pitching and Leveling: Use a (3) three-component fast setting troweled epoxy grout or mortar. Resinous epoxy based grout or mortar designed for permanent repairs under flooring system. Tnemec Series 237 Power-Tread Epoxy Mortar. See drawings for fill locations. Use standard drain details, saw cut and chase.

PART 3 - EXECUTION

3.1 PREPARATION

- A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.
- B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
 1. Mechanically prepare substrates as follows:
 - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup (Reference SSPC-SP 13 / ICRI CSP 4-5).
 - b. Comply with ASTM C 811 requirements, unless manufacturer's written instructions are more stringent.
 2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Verify that concrete substrates are dry.
 - a. Perform in situ probe test, ASTM F 2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity of 99 percent.
 - b. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of **20** lb of water/1000 sq. ft. of slab in 24 hours.
 - c. Perform additional moisture tests recommended by manufacturer. Proceed with application only after substrates pass testing.
 4. Verify that concrete substrates have neutral Ph and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.
- D. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
- E. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations. Allowances for Tnemec Series 201.

3.2 APPLICATION

- A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum inter-coat adhesion.
 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
 3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
 - a. Apply joint sealant to comply with manufacturer's written recommendations.
- B. Integral Cove Base: Install a 6" rolled radius cove base in accordance with the manufacturers instructions
- C. Follow all manufacturer's application instructions strictly.

3.3 TERMINATIONS

- A. Chase edges to "lock" the coating system into the concrete substrate along lines of termination.
- B. Penetration Treatment: Lap and seal coating onto the perimeter of the penetrating item by bridging over compatible elastomer at the interface to compensate for possible movement.
- C. Trenches: Continue coating system into trenches to maintain monolithic protection. Treat cold joints to assure bridging of potential cracks.
- D. Treat floor drains by chasing the coating to lock in place at point of termination.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3.4 JOINTS AND CRACKS

- A. Treat control joints to bridge potential cracks and to maintain monolithic protection.
- B. Treat cold joints and construction joints to bridge potential cracks and to maintain monolithic protection on horizontal and vertical surfaces as well as horizontal and vertical interfaces.
- C. Discontinue floor coating system at vertical and horizontal contraction and expansion joints by installing backer rod and compatible sealant after coating installation is completed. Provide sealant type recommended by manufacturer for traffic conditions and chemical exposures to be encountered.

3.5 FIELD QUALITY CONTROL

- A. Material Sampling: Owner may at any time and any numbers of times during resinous flooring application require material samples for testing for compliance with requirements.
 - 1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
 - 2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
 - 3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

3.6 CLEANING, PROTECTING, AND CURING

- A. Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 18 hours.
- B. Protect resinous flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. General Contractor is responsible for protection and cleaning of surfaces after final coats.
- C. Cleaning: Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer

END OF SECTION 09 67 16

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 9: FINISHES
Section 09 83 00: Acoustical Spray Finish

Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section.

1.1 GENERAL:

- A. This section includes the application of spray medium texture ceiling decorative finish for application over gypsum board, precast concrete hollow core, or poured in place concrete ceilings equal to Georgia Pacific, Gold Bond or U.S. gypsum.
- B. Surfaces must be primed with a sealing latex primer.

1.2 APPLICATION:

- A. For gypsum surfaces, including joint-treated areas, must be smooth, clean and dry. First apply a coat of sealing latex primer. Allow primer to dry thoroughly and maintain adequate drying conditions after application. Primer is to minimize sagging of gypsum wallboard and discoloration or difference in sheen on ceiling surface. Add dry texture to water. Use a piston pump or Moyno-type pump with a texture gun. Minimum 3/4" I.D. material hose. A hopper-type gun with adequate air supply is also suitable. Typical coverage is 8-10 sq.ft. per lb. Mask appropriate areas before spraying and promptly remove overspray from unprotected surfaces afterward. Follow the instructions of the spray equipment manufacturer of adjusting controls and cleaning.
- B. For concrete: Allow concrete to cure for at least 28 days. Clip protruding wire ends and spot with rust-inhibitive primer. Remove all form oil, grease and dirt, or any loose or water-soluble material. Grind down any form ridges, and level any remaining unevenness with Sta-Smooth Joint Compound. Apply a coat of alkali-resistant, sealing latex primer over the entire surface to be textured.

1.3 FINISH:

- A. Finish shall be as approved by Architect.

End of Section 09 83 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 9: FINISHES
Section 09 90 00: Painting

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this Section.

1.2 SUMMARY

- A. This Section includes surface preparation, coatings and finishes for exposed interior and exterior items and surfaces.

1. Surface preparation and all materials specified in this section are in addition to shop-priming and surface treatment specified under other sections.

- B. Paint exposed surfaces whether or not colors are designated in schedules, except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, material shall be as indicated in the coating schedule and color shall be same as adjacent surfaces.

1. This section includes field coating of exposed bare and covered piping and ductwork (including color coding), hangars, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.

- C. Painting is not required on pre-finished items, finished metal surfaces, concealed surfaces, operating parts, and labels.

1. Pre-finished items not to be painted include (but are not limited to) the following items:

- a. Metal toilet enclosures.
- b. Acoustic materials.
- c. Architectural woodwork and casework.
- d. Finished mechanical and electrical equipment.
- e. Light fixtures.
- f. Switchgear.
- g. Distribution cabinets.

2. Concealed surfaces not to be painted include (but are not limited to) the following items:

- a. Foundation spaces.
- b. Furred areas.
- c. Utility tunnels.
- d. Pipe spaces.
- e. Duct shafts.

3. Finished metal surfaces not to be painted include (but are not limited to) the following items:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Anodized aluminum.
 - b. Stainless steel.
 - c. Chromium plate.
 - d. Copper.
 - e. Bronze.
 - f. Brass.
4. Operating parts not to be painted include (but are not limited to) the following items:
- a. Valve and damper operators.
 - b. Linkages.
 - c. Sensing devices.
 - d. Motor and fan shafts.
5. Labels: Do not paint over Underwriters Laboratories, Factory Mutual or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
- D. Related Sections: The following Sections contain requirements that relate to this Section.
1. Division 5 Section "Metal Fabrications" for shop-priming ferrous metal.
 2. Division 6 Section "Interior Architectural Woodwork" for shop-priming interior architectural woodwork.
 3. Division 8 Section "Standard Steel Doors and Frames" for shop-priming steel doors and frames.
 4. Divisions 15 and 16: Painting mechanical and electrical work is specified in Divisions 15 and 16 respectively.

1.3 ABBREVIATIONS

ANSI	American National Standards Institute
DFT	Dry Film Thickness
DFTPC	Dry Film Thickness Per Coat
mil (or "M")	Thousandths of an Inch
NACE	National Association of Corrosion Engineers
OSHA	Occupational Safety and Health Act
SFPG	Square Feet Per Gallon
SFPGPC	Square Feet Per Gallon Per Coat
-SP	Surface Preparation
SSPC	Steel Structures Painting Council

1.4 SUBMITTALS

- A. Submit materials according to Conditions of the contract and in accordance with "PART MATERIALS", herein.
- B. Furnish product data sheets for each coating system used herein, including Technical Data Sheets, and colors available (where applicable) for each product used in the coating system,

except for products applied by equipment manufacturers.

- C. Samples for Verification Purposes: Provide samples of each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate.
1. Provide stepped samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.
 2. Provide a list of material and application for each coat of each sample. Label each sample as to location and application.
 3. Submit samples on the following substrates for the Architect's review of color and texture only:
 - a. Concrete: Provide two 4-inch-square samples for each color and finish.
 - b. Concrete Masonry: Provide two 4-by-8-inch samples of masonry, with mortar joint in the center, for each color and finish.
 - c. Painted Wood: Provide two 12-inch-square samples of each color and material on hardboard.
 - d. Stained or Natural Wood: Provide two 4-by-8-inch samples of natural and stained wood finish on actual wood surfaces.
 - e. Ferrous Metal: Provide two 4-inch-square samples of flat metal and two 8-inch-long samples of solid metal for each color and finish.

1.5 QUALITY ASSURANCE

- A. Applicator's experience: Minimum 5 year's practical experience in application of specified products on projects of similar size and scope. Applicator shall have successfully completed 5 similar projects within the last 3 years. General Contractor shall provide reference names and telephone numbers upon request.
- B. Single-Source Responsibility: Provide primers and undercoat materials produced by the same manufacturer as the finish coats.
- C. Field Samples: On wall surfaces and other exterior and interior components, duplicate finishes of prepared samples. Provide full-coat finish samples on at least 100 square feet of surface until required sheen, color, and texture are obtained; simulate finished lighting conditions for review of in-place samples.
1. Final acceptance of colors will be from job-applied samples.
 2. The Architect will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted. Apply coatings in this room or surface according to the schedule or as specified.
 - a. After finished are accepted, this room will be used to evaluate coating systems of a similar nature as the job standard.

1.6 MATERIAL DELIVERY, HANDLING, AND STORAGE

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Deliver materials to project site in undamaged, unopened containers that plainly show, at time of use:
 - 1. Product name and manufacturer.
 - 2. Product Description (generic classification or binder type).
 - 3. Date of manufacture.
 - 4. Contents by volume.
 - 5. Batch number.
 - 6. Shelf-life.
 - 7. Color.
 - 8. Mixing, thinning, and application instructions.

- B. Store materials in a protected area that is heated or cooled to maintain a temperature range recommended by coating manufacturer.
 - 1. Protect from freezing.
 - 2. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Coatings shall only be applied during good painting weather. Air and surface temperatures shall be within limits described by the manufacturer for the coating being applied and surface temperatures shall be at least 5° F above the dew point of ambient air. Work areas shall be reasonably free of airborne dust and smoke at time of application and during cure or drying.
 - 1. Cold weather painting: Follow manufacturer's product data sheets for application temperature limits and accelerated curing charts. Contact manufacturer for any deviations from published guidelines.

- B. Abrasive blasting shall only be performed when relative humidity is less than 85% and when surface temperature is at least 5° F above the dew point of ambient air.

1.8 WARRANTY

- A. The General Contractor shall warrant to the owner and guarantee the Work under this section against defective workmanship and material as outlined in the Contract Documents.

PART 2 MATERIALS

- 2.1 All materials specified herein are Basis of Design for use on this project. Acceptable prior approved Manufacturers: Tnemec, PPG Architectural Finishes, Inc. - Pittsburgh Paints, Sherwin-Williams, ICI and Benjamin Moore.

- 2.2 Materials specified are those which have been evaluated for the specific service. Products are listed to establish a *standard of quality and performance*. Requests for substitution must be approved in writing ten (10) days prior to date of bid. Substitute systems must have required documentation. The burden of proof of the merit of the proposed substitute is upon the proposer. The decision of the Architect regarding approval or disapproval of the

proposed substitution shall be final.

2.3 SUBSTITUTIONS

- A. Requests for substitution shall contain the following technical product information:
1. Full name and number of each product
 2. Complete descriptive literature
 3. Directions for use
 4. Generic Vehicle Type
 5. Material Safety Data Sheets (MSDS)
 6. Certification that all products are formulated free of lead and chromates
 7. Percent (%) Solids by Volume
 8. Recommended Dry Film Thickness per coat
 9. Independent certified test reports showing results to equal the performance criteria of the products specified.
- B. Materials supplied by other manufacturers may be considered for substitution if the following prevailing conditions exist:
1. Performance criteria of the specified materials are exceeded by the submitted alternate materials as listed in paragraph 2.1 and detailed on the technical data sheets of each specified product.
 2. No products shall be considered that would decrease film thicknesses or offer a change in generic type of coating specified.
 3. The submittal must compare the performance criteria of the specified material with that of submitted material and be documented in a side by side manner for thorough Architect review.
 4. Substitute materials must be for complete systems and not individual products combined with the specified materials. Performance criteria for all products within a system must meet or exceed the specified materials.
 5. Only one (1) alternate submittal will be received for this specification and must be accompanied by a detailed statement of the sum to be added or deducted from the base bid.
- C. Materials supplied by other manufacturers must include the following performance data as certified by a qualified testing laboratory:
1. ASTM B117 Method of Salt Spray (Fog) Testing
 2. ASTM D149 Method of Dielectric Breakdown Voltage and Dielectric Strength Electrical Insulating Materials of Commercial Power Frequencies.
 3. ASTM D3359 Method for Measuring Adhesion by Test Tape.
 4. ASTM D3363 Method for Film Hardness by Pencil Test.
 5. ASTM D4060 Method for Abrasion Resistance of Organic Coatings by the Taber Abrader.
 6. ASTM D4541 Method for Pull-Off Strength of Coats Using Portable Adhesion Testers.
 7. ASTM 4585 Practice Testing the Water Resistance of Coatings Using Controlled

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

8. ASTM G53 Condensation.
Practice for Operating Light and Water Exposure of Non-metallic
Materials.

PART 3 EXECUTION

3.1 GENERAL

A. Surface Preparation Inspection:

1. Inspect and provide substrate surfaces prepared in accordance with these Specifications and the printed instructions and recommendations of the manufacturer whose product is to be applied.
2. Provide Architect minimum 14 day's advance notice prior to start of surface preparation work or coating application.
3. Perform work only in presence of Architect, unless Architect grants prior approval to perform work in Architect's absence.

3.2 PROTECTION OF MATERIALS NOT TO BE PAINTED

- A. Remove, mask, or otherwise protect hardware, lighting fixtures, switch plates, aluminum surfaces, machined surfaces, couplings, shafts, bearings nameplates, and other surfaces not intended to be painted. Provide protection to prevent coating materials from falling on or marring adjacent surfaces. Protect working parts of mechanical and electrical equipment from damage. Mask openings in motors to prevent paint and other materials from entering.

3.3 APPLICATION SAFETY

A. Perform painting work in accordance with recommendations of the following:

1. Coating manufacturer's printed instructions.
2. NACE guidelines, contained in the publication, "Manual for Painter Safety."
3. Federal, State, and Local agencies having jurisdiction.

- B. The General Contractor will be solely and completely responsible for conditions of the jobsite, including safety of all persons (including facility employees) and property during performance of the work. The General Contractor will comply with all safety training requirements promulgated or required for this project.

C. Surface Preparation and Coating Precautions:

1. Ventilation: During field abrasive blasting, nozzle operators shall wear air-supplied helmets and all other persons who are exposed to blasting dust shall wear filter-type respirators and safety goggles or other personal protective equipment required by local, state, and federal safety regulations. When coatings are applied inside confined spaces, all persons exposed to toxic vapors shall wear air-supplied masks.
2. Grounding: Precautions shall be taken during blast cleaning and coating operations to prevent accumulation of charges of static electricity. Blasting hoses, coating lines, etc. shall be grounded to meet local, state, and federal safety regulations. Note that sparking due to

improper grounding may result in explosion of concentrated solvent vapors.

3. Lighting: Spark-proof artificial lighting shall be provided for all work inside confined spaces. Lightbulbs shall be guarded to prevent breakage. Lighting fixtures and flexible cords shall comply with the requirements of NFPA 70, National Electrical Code, for the atmosphere in which they will be used. Note that sparking may result in explosion of concentrated solvent vapors.
4. Toxicity: Most protective coatings contain solvents and other raw materials that can be health hazards if appropriate safety precautions are not taken. Personal exposure to solvent vapors shall be maintained below the permissible exposure limit (PEL). Follow local, state, and federal safety regulations and applicable hazardous warning information on container labels, manufacturer's literature, and material safety data sheets (MSDS) prior to storage, handling, and use.
5. Fire: During mixing and application of coatings, all flames, welding, and smoking shall be prohibited in the vicinity. An appropriate type of fire extinguisher shall be kept within the areas of mixing and application operations.
6. Blasting and Coating Operations: All blasting and coating operations shall be carried out in compliance with local, state, and federal regulations. General Contractor shall adhere to all applicable safety, environmental, emissions, noise, and material disposal regulations.

3.4 PAINT MIXING AND THINNING

- A. Multiple-Component Coatings:
 1. Prepare using all the contents of the container for each component as packaged and directed by paint manufacturer. No partial batches will be permitted.
 2. Thinning, when permitted, will be done in strict accordance with the most current manufacturer's printed product data sheet.
 3. Do not use multiple-component coatings after they have been mixed beyond their pot life.
- B. Keep paint materials sealed when not in use.
- C. When multiple coats of material are applied within a given system, alternate color (job tint) coats to provide a visual reference that the required number of coats have been applied.

3.5 FIELD ABRASIVE BLASTING

- A. Perform abrasive blasting for items and equipment where specified and as required to restore damaged surfaces previously shop or field blasted and primed. Materials, equipment, and procedures shall be in accordance with recommendations of the Steel Structures Painting Council (SSPC) or the National Association of Corrosion Engineers (NACE).

3.6 PREPARATION OF SURFACES

- A. Metal Surface Preparation:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. General: Conform to current Steel Structures Painting Council (SSPC) Specifications as follows:
 - a. Solvent Cleaning: SSPC-SP 1
 - b. Hand Tool Cleaning: SSPC-SP 2
 - c. Power Tool Cleaning: SSPC-SP 3
 - d. Commercial Blast Cleaning: SSPC-SP 6 or NACE No. 3
 - e. Brush-Off Blast Cleaning: SSPC-SP 7 or NACE No. 4
 - f. Near-White Blast Cleaning: SSPC-SP 10 or NACE No. 2
 - g. Power Tool Cleaning to Bare Metal: SSPC-SP 11
2. Field Blasting: Where OSHA or EPA regulations preclude standard abrasive blast cleaning, wet or vacu-blast methods may be required. Follow coating manufacturer's recommendations for wet blast additives and first coat application. Blast Cleaning Requirements:
 - a. Comply with applicable federal, state, and local air pollution and environmental control regulations for blast cleaning and disposition of spent aggregate and debris.
 - b. Alternatives to standard abrasive blast cleaning methods shall be subject to Architect review.
3. Hand tool clean areas that cannot be cleaned by power tool cleaning.

B. Concrete, Masonry, and Stucco Surface Preparation:

1. Complete and cure concrete, masonry, and stucco construction at least 28 days before starting surface preparation work.
2. Remove oil, grease, dirt, salts, curing agents, other chemicals, loose materials, or foreign matter by solvent, detergent washing, or other suitable cleaning methods.
3. Clean concrete, masonry, and stucco surfaces of mortar and grout spillage and other surface deposits using one of the following:
 - a. Nonmetallic fiber brushing with a solution of muratic acid (1 part muratic acid/3 parts water), followed by rinsing with clean water.
 - b. Brush-off blasting per SSPC-SP7 or NACE No. 4.
 - c. Water blasting
4. Determine alkalinity and moisture content of surfaces by performing ASTM D 4262 "Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces" and, respectively, ASTM D 4263 "Standard Test Method for Indicating Moisture Content in Concrete by the Plastic Sheet Method". If surfaces are sufficiently alkaline to cause the coatings to blister or "burn", correct this condition by using "Chlor*Rid Concentrate" added to water in a 100-to-1 concentration while pressure washing. An alternate method is to apply "Chlor*Rid Direct-To-Surface" by roller or squeegee and rinsed thoroughly using clean water.
5. Leave surfaces clean, with adequate surface profile, and (unless otherwise required for proper adhesion) dry prior to painting.

C. Drywall Surface Preparation: Fill and sand smooth all cracks, holes and other surface

imperfections. Insure that all drywall is clean and dry prior to coating application. While coating is curing/drying keep dust and surface contaminants to a minimum.

3.7 APPLICATION OF COATINGS

A. General:

1. Inspection: Schedule inspection with Architect in advance for prepared surfaces and all coats prior to restarting coating applications.
2. Apply coatings in accordance with manufacturer's printed data sheets. Allow sufficient time between coats to insure complete curing of previously applied coatings.
3. Paint units or structures to be bolted together prior to their assembly, when possible.
4. The term exposed surfaces includes areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
5. Paint surfaces behind moveable equipment and furniture the same as exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts, where visible through registers or grilles, with Series 66-IN06 (Black) Hi-build Epoxoline.
7. Paint back sides of access panels and removable or hinged covers to match existing surfaces.
8. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
9. Finish exterior doors on tops, bottoms, and side edges same as exterior faces.
10. Omit primer on metal surfaces that have been shop-primed and touch-up painted.
11. Colors, surface preparation, and paint systems are detailed in "PART 4", herein.

B. Shop Primed or Factory Finished Surfaces:

1. After welding, prepare and prime holdback areas as required for specified paint system. Apply primer according to manufacturer's instructions.
2. Hand or power sand areas of chipped, peeled, or abraded coating, feathering the edges. Apply the specified spot primer to cover the area.
3. For two-component coatings, consult the coatings manufacturer for specific procedures relating to the manufacturer's products.
4. Prior to application of finish coats, clean shop primed surfaces free of dirt, oil, and grease per SSPC-SP1 and apply a mist coat of specified primer at 1.0 MDFT.

C. Manufacturer Applied Paint Systems:

1. Repair abraded areas on factory finished items in accordance with the equipment manufacturer's directions.
2. Carefully blend repaired areas into original finish.

D. Film Thickness

1. Coverage is listed as either total minimum dry film thickness in mils (MDFT) or the spreading rate in square feet per gallon (SFPG). Per coat determinations are listed as MDFTPC and SFPGPC.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Number of coats: Minimum required irrespective of coating thickness. Additional coats may be required to achieve minimum required coating thickness, depending on method of application, differences in atmospheric conditions, and individual manufacturer's products.
 3. Maximum film build per coat shall not exceed coating manufacturer's printed recommendations.
 4. Give particular attention to edges, angles, flanges, and other similar areas where insufficient film thicknesses are likely to be present, and ensure proper millage in these areas.
 5. Dry Film Thickness Testing:
 - a. Check each coat for correct millage. Do not take DFT measurements until coatings have cured a minimum of 8 hours.
 - b. After repaired and recoated areas have cured sufficiently, final tests will be conducted by the Architect, measuring coating thickness, as specified in mils, with a magnetic type dry film thickness gauge as outlined in SSPC-PA2 "Measurement of Dry Paint Thickness with Magnetic Gauges" ..
- E. Mechanical and Electrical Work: Painting mechanical and electrical work is limited to items exposed in mechanical equipment rooms and in occupied spaces.
- F. Mechanical items to be painted include (but are not limited to) the following:
1. Piping, pipe hangars, and supports.
 2. Heat exchangers.
 3. Tanks.
 4. Ductwork.
 5. Insulation.
 6. Supports.
 7. Motors and mechanical equipment.
 8. Accessory items.
- G. Electrical items to be painted include (but are not limited to) the following:
1. Conduit and fittings.
 2. Switchgear.
- H. Unsatisfactory Application:
1. If an item has improper finish color or insufficient film thickness, clean and recoat the surface with specified material to obtain specified sheen, color, texture, and coverage.
 2. Hand or power sand visible areas of chipped, peeled, or abraded paint, and feather the edges. Follow with primer and finish coat in accordance with the specifications. Depending on extent of repair, finish sanding and additional topcoats may be required.
 3. Evidence of runs, drips, bridges, shiners, laps, or other imperfections shall be cause for rejection.
 4. Repair defects in coating system per written recommendations of coating manufacturer.
 5. Leave all staging up until the Architect has inspected surface or coating.
 6. Replace staging removed prior to approval of the Architect.

3.8 CLEANUP AND REMOVAL OF WASTE

- A. Place cloths and waste that might constitute a fire hazard in closed metal containers or destroy

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
 MENTAL HEALTH / MEDICAL UNIT
 ANNISTON, ALABAMA

at the end of each day.

- B. Upon completion of work, remove all staging and scaffolding from site.
- C. Completely remove paint drips, overspray, or stains from surfaces not scheduled to be painted, and leave entire job clean.
- D. Remove and dispose of, in a manner legal in the State of Alabama, all rubbish, empty containers, coating materials (including spent solvents), leaving the premises in an acceptable condition.

PART 4 COATING SYSTEMS

4.0 PROTECTIVE COATING SYSTEMS

System No.	Title
1	Exposed Metal--Exterior
2	Exposed Metal--Interior
3	Precast Concrete, Masonry, and Concrete—Interior
4	Gypsum Board/Drywall
5	Woodwork and Hardboard
6	Stained Woodwork--Where Indicated
7	Plant Precast Concrete – Interior
8	Cast In Place Concrete - Exterior

System No. 1 Exposed Metal--Exterior (including Section 08331, Overhead Coiling Doors):
 This systems is only applicable at Bid Item No. 1

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive or Centrifugal Wheel Blast (SSPC-SP 6 Commercial Blast Cleaning)	Series 132, ProTuff	1 Coat, 4.0-6.0 MDFT
	SW Pro Acrylic DTM	
	Series 66 Epoxoline,	1 Coat, 3.0-5.0 MDFT
	SW Pro Industrial Pre Catalyzed Urethane	
	Series 1095 Endura-Shield	1 Coat, 2.0-3.0 MDFT
	SW Pro Industrial Pre Catalyzed Urethane	

System No. 2 Exposed Metal--Interior (including ferrous metals, access doors, steel security furnishings, security equipment, steel mechanical grilles, exposed sprinkler piping and fire extinguisher cabinets unless otherwise shown):

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive or Centrifugal Wheel Blast (SSPC-SP 6 Commercial Blast Cleaning)	Series 132, ProTuff, SW Pro Acrylic DTM	1 Coat, 4.0-6.0 MDFT

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
 MENTAL HEALTH / MEDICAL UNIT
 ANNISTON, ALABAMA

Series 113 Tneme-Tufcoat	1 Coat, 3.0-5.0 MDFT
SW Metalatex Acrylic Coating	
Series 297 Enviro-Glaze	1 Coat, 2.0 – 3.0 MDFT
SW Metalatex Acrylic Coating	

System No. 3 Concrete and Masonry – Interior:

Surface Prep.	Paint Material	Min. Coats, Cover
Dry & Clean	Series 130, Envirofill SW Conflex Block Filler	1 Coat, 75 SFPG
	Series 113 Tneme – Tufcoat SW Pro Industrial Acrylic Coating	1 Coat, 3.0-5.0 MDFT
	Series 297 Enviro-Glaze SW Pro Industrial Acrylic Coating	1 Coat, 2.0 – 3.0 MDFT

System No. 4 Gypsum Board (Drywall):

Surface Prep.	Paint Material	Min. Coats, Cover
Dry & Clean	PVA Drywall Primer and Sealer	1 Coat, 1.0-2.0 MDFT
	Series 113 H.B, Tneme-Tufcoat, SW Pro Industrial Acrylic Coating	2 Coats, 3.0-4.0 MDFTPC

System No. 5 Woodwork and Hardboard (including interior doors, cabinets and wood trim unless otherwise shown):

Surface Prep.	Paint Material	Min. Coats, Cover
Dry & Clean – Sand Smooth fill nicks and nail holes with appropriate filler	Series 10-99W, Tnemec Primer, SW Multi-Purpose Acrylic Alkyd Primer	1 Coat, 2.0-3.0 MDFT
	Series 1029, Enduratone, SW Pro Industrial Acrylic Coating	2 Coats, 1.0-3.0 MDFTPC

System No. 6 Stained Woodwork:

1. Stained-Varnish Rubbed Finish: Three finish coats over stain plus filler on open-grain wood. Wipe filler before applying first varnish coat.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Stain Coat: Oil-type interior wood stain.
 - 1) ICI: 96XX Wonder Woodstain Alkyd Stain.
 - 2) Fuller: 640-XX Pen-Chrome Interior Oil Base Wood Stain.
 - 3) Moore: 241 Moore's Interior Wood Finished Penetrating Stain.
 - 4) PPG: 77-302 Rez Medium Tint Base.
 - 5) P & L: S-Series Tonetic Wood Stain.
 - 6) S-W: Oil Stain A-48 Series.

- b. First Coat: Cut shellac.
 - 1) ICI: 4900 Wonder Woodsealer Quick-Dry Sealer.
 - 2) Moore: 413 Moore's Interior Wood Finishes Quick-Dry Sanding Sealer.
 - 3) PPG: 77-30 Quick Drying Sanding Sealer.
 - 4) S-W: Pro-Mar Varnish Sanding Sealer B26V3.

- c. Filler Coat: Paste wood filler.
 - 1) ICI: 4800 Wonder Woodstain Interior Paste Wood Filler.
 - 2) Fuller: 680-00 Pen Chrome Paste Wood Filler.
 - 3) Moore: Benwood Paste Wood Filler #238.
 - 4) PPG: (none required)
 - 5) S-w: Sher-Wood Fast-Dry Filler.

- d. Second and Third Coats: Oil rubbing varnish.
 - 1) ICI: 4600 Wonder Woos Stain Alkyd Stain Varnish.
 - 2) Fuller: 653-01 EPA Complaint Clear Polyurethane Satin Finish.
 - 3) Moore: Benwood Stain Finish Varnish #404.
 - 4) PPG: 77-7 Rez Stain Varnish.
 - 5) P & L: Clear Finish Glass.

PART 5 - PAINTED GRAPHIC SIGNAGE

5.0 See drawings for special painted signage. Edges of letters and figures shall be straight sharp and concise.

Painting subcontractor through General Contractor shall furnish templates for all text/copy scheduled above for paste-up approval on project site. Paint one (1) full sample for approval by A/E and Owner's Representative before any work is begun.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

END OF SECTION 09 90 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 9: FINISHES
Section 09 96 53: Elastomeric Coatings

PART I. - GENERAL

A. RELATED DOCUMENTS

1. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section..

B. SUMMARY

1. This Section includes the following:
 - a. Surface preparation, including crack repair.
 - b. Application of elastomeric coating systems to exterior surfaces as scheduled, including prime coats, if required, and finish coats to include all exposed precast concrete detention module panel surfaces.
 - c. Maintenance and repair requirement for period of one (1) year from date of final acceptance.

C. SYSTEM PERFORMANCE REQUIREMENTS

1. Performance Requirements: Provide elastomeric coating systems that comply with performance requirements specified when tested according to test methods indicated.
 - a. Fungal, Mold and Mildew Resistance: ASTM D 3273, 90°F (32°C), 95-98% R.H., suspended 3" above soil containing aspergillus niger, aspergillus oryzae and an unknown species of penicillium. System applied to drywall panels and exposed for 5 weeks.
 - b. Adhesion: ASTM D 7234. Report PSI Adhesion.
 - c. Humidity: ASTM D 4585. 2,000 hours exposure.
 - d. Moisture Vapor Transmission: ASTM D 1653 (Method B), Wet Cup, Condition C at 70°F (38°C). Material applied in free film.
 - e. QUV Exposure: ASTM D 4587. 5,000 hours Exposure.
 - f. Salt Spray (Fog): ASTM B 117. 5,000 hours Exposure.
 - g. Tensile Strength, Elongation and Modulus of Elasticity: ASTM D 2370
 - h. Wind Driven Rain: TT-C-555B, Section 4.4.7.3. Two coats applied to light weight block.

D. SUBMITTALS

1. General: Submit the following according to Conditions of the Contract.
2. Product data for each elastomeric coating system specified.
 - a. Include technical information, basic materials analysis and instructions for handling, storage, and application.
 - b. List each coating material and cross-reference the specific coating application. Identify each material by manufacturer's catalog number and general classification.
 - c. Certification by the elastomeric coating system manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOC's).

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Samples for initial color selection in the form of manufacturer's color charts.
4. Product test reports from a qualified independent testing agency evidencing compliance of elastomeric coatings with requirements indicated based on comprehensive testing within the last two years of current product formulations.
5. Material certificates, in lieu of agency test reports, when permitted by the Architect, signed by the manufacturer certifying that each material complies with requirements specified.

E. QUALITY ASSURANCE

1. **Applicator Qualifications:** Engage an experienced applicator who has completed coating system applications similar in material and extent to those indicated for the Project that have resulted in construction with a record of successful in-service performance.
2. **Single-Source Responsibility:** Provide primers and other undercoat material produced by the same manufacturer as the finish coats.
 - a. Notify the Architect of problems anticipated using coatings systems specified.
3. **Field Samples:** The Architect will select one exterior wall surface type for each substrate to represent surfaces and conditions to include poured in place concrete and precast detention module panel surfaces. Apply coatings to each surface according to the schedule, or as specified. Provide full-coat samples on at least 100 sq. ft. until required color and texture are obtained.
 - a. After finishes are accepted, these surfaces will be used to evaluate the coating systems. Final acceptance of colors will be from job-applied samples.

F. DELIVERY, STORAGE AND HANDLING

1. Deliver elastomeric coating materials to the job site in the manufacturer's original, new, unopened packages and containers bearing manufacturer's name and label and the following information:
 - a. Name or title of material.
 - b. Manufacturer's name, stock number, and date of manufacture.
 - c. Contents by volume.
 - d. Thinning instructions (if permitted).
 - e. Application instructions.
 - f. Color name and number.
 - g. Handling instructions and precautions.
2. Store materials not in actual use in tightly covered containers at a minimum ambient temperature of 45 deg F (7 deg C) in a well-ventilated area. Maintain containers used in storage of coatings in a clean condition, free of foreign materials and residue.
 - a. Protect elastomeric coating materials from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workmen and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

G. PROJECT CONDITIONS

1. Temperature Conditions: Apply coatings only when the temperature of surfaces to be coated and surrounding air temperatures are above 50 deg F (10 deg C), unless otherwise permitted by manufacturer's printed instructions.
2. Weather Conditions: Do not apply coatings in snow, rain, fog, or mist; when the relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before proceeding with or continuing coating operation.

H. WARRANTY

1. Elastomeric Coating Warranty: Submit a written warranty executed by the manufacturer, agreeing to repair or replace elastomeric coatings that fail within the warranty period. Failures include but are not limited to:
 - a. Water penetration through the coating.
 - b. Warranty period for elastomeric coatings is 10 years after the date of Final Acceptance.
 - c. The warranty shall not deprive the Owner or other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.
2. In addition, the Contractor shall be responsible for all maintenance and repair , up to and including complete recoating of the Elastomeric Coating application at all areas in order to maintain coating in a like new state for a period of one (1) year after the date of final acceptance.

PART II. - PRODUCTS

A. MANUFACTURERS

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering coating materials that may be incorporated in the Work include, but are not limited to, the following:
 - a. Sherwin Williams (Basis of Design)
 - b. Tnemec Company
 - c. Dulux
 - d. Gulf Coast Paint
 - e. Prior approved equivalent, submit for approval

B. ELASTOMERIC COATING MATERIALS, GENERAL

1. Material Compatibility: Provide crack fillers, primers, elastomeric finish coat materials, and related materials that are compatible with one another and the substrates under conditions

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

of service and application, as demonstrated by the manufacturer based on testing and field experience.

2. Material Quality: Provide the best quality grade of elastomeric coatings. Materials not displaying manufacturer's identification as a best-grade product will not be acceptable.
 - a. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products of named manufacturers are required to be used to the exclusion of equivalent products of other manufacturers.
3. Colors: Provide color selections made by the Architect from the manufacturer's full range of standard colors for elastomeric coating systems.

C. CRACK FILLERS

1. Crack Fillers: Provide the manufacturer's standard factory-formulated acrylic emulsion crack fillers that are compatible with the substrate and finish coat materials indicated.

D. PRIMERS

1. Primers: Provide the manufacturer's standard, factory-formulated prime coat materials that are compatible with the substrate and finish coats indicated.

E. ACRYLIC ELASTOMERIC COATING

1. Finish Coats: Provide factory-formulated, modified waterborne acrylate elastomeric finish coating material compatible with the substrate and primer indicated.

PART III. - EXECUTION

A. EXAMINATION

1. Examine substrates and conditions under which elastomeric coating systems will be applied for compliance with requirements for application. Surfaces to receive elastomeric coatings must be thoroughly dry before coatings are applied.
 - a. Notify the Architect in writing of anticipated problems using coatings specified with substrates primed by others.
 - b. Do not proceed with application until unsatisfactory conditions have been corrected.
 - c. Start of coating within a particular area will be construed as the Applicator's acceptance of surface conditions.

B. PREPARATION

1. General: Remove hardware, hardware accessories, plates, machined surfaces, light fixtures, and similar items that are not to be coated, or provide surface-applied protection prior to surface preparation and coating. Remove these items, if necessary, to completely coat the substrates and adjacent surfaces. Following completion of coating operations in each area, reinstall items removed, using workers skilled in the trades involved.
2. Cleaning: Before applying coatings or other surface treatments, clean substrates of

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

substances that could impair bond of coating systems. Schedule cleaning and coating application so dust and other contaminants will not fall on wet, newly coated surfaces.

3. Surface Preparation: Clean and prepare surfaces to be coated according to the manufacturer's instructions for the particular substrate conditions, and as specified.
 - a. Cementitious Surfaces: Prepare surfaces of concrete, concrete masonry, stucco, and similar surfaces to receive elastomeric coatings by removing efflorescence, chalk, dust, dirt, release agents, grease, oils, and similar conditions by water blasting followed by a clear water rinse.
 - (1) Remove mildew and neutralize surfaces according to the manufacturer's recommendations before patching materials are applied.
 - (2) If hardeners or sealers have been used to improve concrete curing, use mechanical methods for surface preparation.
 - (3) Determine alkalinity and moisture content of surfaces to be coated by performing appropriate tests. Do not apply coatings over surfaces where moisture content exceeds that permitted in the manufacturer's printed directions.
 - b. Crack Repair: Fill cracks according to manufacturer's recommendations prior to coating surfaces. NOTE: If non-compliant cracking, textures, or other non conforming surface deformations are encountered on precast concrete module surfaces, the Architect and Program Manager will be notified and the PCMC will be required to repair on site.
 - c. Deep Hairline Cracks: Remove dust and dirt from around the crack, and remove mildew by sterilizing before filling. Apply manufacturer's recommended primer to cracks before patching. If shrinkage occurs after applying the crack filler, apply additional filler material to cracks before initially applying the elastomeric coatings.
 - (1) Cracks up to 1/16 Inch: Clean the surface around the crack. Apply primer penetrating the crack as deeply as possible, overflowing the crack 2 inches on each side. When primer is dry, apply manufacturer's recommended sealant, forced well into the crack using a brush, putty knife, or trowel. Smooth edges around the crack over the primed area. Allow for sealant shrinkage when applying.
 - (2) Cracks up to 3/8 Inch: Open cracks to 1/4 to 3/8 inch wide and 1/8 inch deep. Clean the crack and surrounding area removing dust, dirt, and other impurities. Apply primer recommended by the manufacturer to the crack with a brush to obtain uniform coverage and spread approximately 2 inches on each side of the crack. Fill the crack with the manufacturer's recommended crack filler applied with a putty knife or trowel, and allow for shrinkage. If excessive shrinkage occurs, reapply crack filler.
4. Material Preparation: Carefully mix and prepare materials complying with the coating manufacturer's directions.
 - a. Stir materials before application to produce a mixture of uniform density, and as required during application. Do not stir film that may form on surfaces into the material. Remove film and, if necessary, strain the coating material before using.
 - b. If the manufacturer permits thinning, use only thinners recommended by the manufacturer, and only within the limits recommended by the manufacturer.

C. APPLICATION

1. General: Apply elastomeric coatings to exposed surfaces indicated to include all exterior exposed surfaces of precast concrete modules. Coating colors, surface treatments, and finishes are indicated in the Schedules in the Contract Documents.
 - a. Colors: Where an item or surface is not specifically mentioned in the Schedules, coat the same color as similar adjacent materials or surfaces. If a color is not designated, the Architect will select a color from standard colors available.
2. Application Procedures: Apply elastomeric coatings by brush, roller, or spray according to manufacturer's directions.
 - a. Brushes: Use brushes best suited for the material being applied.
 - b. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
 - c. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.
3. Minimum Coating Thickness: Apply each material no thinner than the manufacturer's recommended spreading rate. Provide the total dry film thickness as recommended by the manufacturer.
 - a. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer.
 - b. Apply primers and finish coats by brush, unless manufacturer's instructions permit other types of applicators.
 - c. Wherever spray application is used, apply each coat to provide the equivalent hiding of brush-applied coats. Do not double back with spray equipment building-up film thickness of two coats in one pass.
4. Prime Coats: If recommended by the manufacturer, apply a prime coat to material being coated before applying finish coats.
5. Brush Application: Brush out and work brush coats into surfaces in an even film. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks.
6. Spray Application: Use spray equipment for application only when permitted by manufacturer's recommendations and governing ordinances and as approved by the PCMC for precast concrete modules.
7. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or recoat work not complying with specified requirements.

D. FIELD QUALITY CONTROL

1. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during the period when coating operations are being conducted.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. The Owner will engage the services of an independent testing agency to sample the coating being used. Samples of material delivered to the Project site will be taken, identified, sealed, and certified in the presence of the Contractor.
- b. The testing agency will perform appropriate tests for the following characteristics as required by the Owner:
 - (1) Quantitative materials analysis.
 - (2) Elongation at break.
 - (3) Tensile strength.
 - (4) Percent of recovery.
 - (5) Resistance to wind-driven rain.
 - (6) Water vapor transmission.
 - (7) Flexibility.
 - (8) Accelerated weathering.
 - (9) Impact resistance.
 - (10) Alkali resistance.
 - (11) Abrasion resistance.
 - (12) Mildew resistance.
- c. If results show materials do not comply with requirements, the Contractor may be directed to stop work, remove noncomplying materials, pay for testing, recoat surfaces coated with rejected materials, or remove rejected materials from previously coated surfaces if, upon recoating with specified materials, the two coatings are not compatible.

E. CLEANING

1. Cleanup: At the end of each work day, remove rubbish, empty cans, rags, and other discarded materials from the site.
 - a. After completing work, clean glass and spattered surfaces. Remove spattered coatings by washing, scraping or other methods, being careful not to scratch or damage adjacent finished surfaces.

F. PROTECTION

1. Protect work of other trades from damage whether being coated or not. Correct damage by cleaning, repairing, replacing, and recoating as acceptable to the Architect. Leave in an undamaged condition.
2. Provide "Wet Paint" signs to protect newly coated finishes. Remove temporary protective wrappings provided by others to protect their work after completing coating operations.
 - a. After construction activities of other trades are complete, touch up and restore damaged or defaced coated surfaces.

G. COATING SCHEDULE

1. Provide the following coating systems for substrates indicated.
 - a. Apply additional coats, if undercoats or other conditions show through the final coat,

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

until the cured film is of uniform coating finish, color, and appearance.

2. CONCRETE: Two finish coats with total dry film thickness not less than 8 mils.
 - a. Primer: Manufacturer's recommended primer.
 - b. First Coat: Sherwin Williams Conflex XL Smooth High Build, Tnemec Series 156 Enviro-Crete, Dulux Weatherguard Decraflex, , applied at 4.0 – 6.0 mils DFT
 - c. Second Coat: Sherwin Williams Conflex XL Textured High Build, Tnemec Series 156 Enviro-Crete, Dulux Weatherguard Decraflex Textured, applied at 4.0 – 6.0 mils DFT

END OF SECTION 09 96 53

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 10: SPECIALTIES
Section 10 14 00: Signs – Bid Item 1

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section.
- B. All building signage shall conform to the requirements of The Americans with Disabilities Act of 1990 with ANSI A117.1. The most stringent criteria shall govern.

1.2 SUMMARY

- A. This Section includes the following types of signs:
 - 1. Standard Braille Interior Wall Mounted Panel signs.
 - 2. Exterior post and panel signage with interchangeable word bars.
 - 3. Dimensional letters and numbers.
 - 4. Cast metal plaques.
 - 5. Project Construction Signage

1.3 SUBMITTALS

- A. General: Submit the following in accordance with specific Conditions of the General Contractor.
- B. Product Data: Include manufacturer's construction details relative to materials, dimensions of individual components, profiles, and finishes for each type of sign required.
- C. Shop Drawings: Provide shop drawings for fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, grounds, reinforcement, accessories, layout, and installation details.
 - 1. Provide message list for each sign required, including large-scale details of wording and layout of lettering.
 - 2. For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.
 - 3. Furnish full-size rubbings for metal plaques.
- D. Samples: Provide the following samples of each sign component for initial selection of color, pattern and surface texture as required and for verification of compliance with requirements indicated.
 - 1. Samples for verification of color, pattern, and texture selected, and compliance with requirements indicated:
 - a. Cast Acrylic Sheet and Plastic Laminate: Provide a sample panel not less than 8-1/2 inches by 11 inches for each material indicated. Include a panel for each color, texture, and pattern required. On each panel include a representative

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

sample of the graphic image process required, showing graphic style, and colors and finishes of letters, numbers, and other graphic devices.

- b. Dimensional Letters: Provide full-size representative samples of each dimensional letter type required, showing letter style, color, and material finish and method of attachment.

1.4 PROJECT CONDITIONS

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cast Acrylic Sheet: Provide cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet, in sizes and thicknesses indicated, with a minimum flexural strength of 16,000 psi when tested in accordance with ASTM D 790, a minimum allowable continuous service temperature of 176 deg F (80 deg C), and of the following general types:
 1. Transparent Sheet: Where sheet material is indicated as "clear," provide colorless sheet in matte finish, with light transmittance of 92 percent, when tested in accordance with the requirements of ASTM D 1003.
 2. White Translucent Sheet: Where sheet material is indicated as "white," provide white translucent sheet of density required to produce uniform brightness and minimum halation effects.
 3. Opaque Sheet: Where sheet material is indicated as "opaque," provide colored opaque acrylic sheet in colors and finishes as selected from the manufacturer's standards.
- B. Aluminum Castings: Provide aluminum castings of alloy and temper recommended by the aluminum producer and finisher for the casting process used and for the use and finish indicated.
- C. Vinyl Film Stencils: Provide opaque nonreflective vinyl film sign painting stencils, 0.0035-inch minimum thickness, with pressure-sensitive adhesive backing, suitable for exterior as well as interior applications.(For use in signage stenciling in Detention Areas).
- D. Fasteners: Use concealed fasteners fabricated from metals that are not corrosive to the sign material and mounting surface.
- E. Anchors and Inserts: Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.
- F. Colored Coatings for Acrylic Plastic Sheet: Use colored coatings, including inks and paints for copy and background colors, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for the application intended.

2.2 PANEL SIGNS

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Standard Braille Interior Wall Mounted Panel Signs: Comply with requirements indicated for materials, thicknesses, finishes, colors, panel designs, shapes, sizes, and details of construction as shown and detailed on drawings..
1. Furnish and install room number and picture signs in quantities and types equal to Best Standard Sign systems in appropriate modules for text, numbers and picture signs with text as outlined herein. Sign types shall be HC200 ADA System or equal as follows:
 - a. Furnish type "A" or "D" copy modules for room numbers and names. See signage schedule and details on drawings. Size shall be 9 3/4" x 9 1/2" with raised copy for room number and name, grade II Braille. Colors shall be selected from BEST standard colors for background and letters. Mounting shall be vinyl tape and silicone adhesive method. All signs shall be mounted not greater than 48" from the floor to the top line of the sign on the wall the strike side of the door opening.

Signage Schedule
Furnish room name and number signs as shown and detailed on signage schedules on drawings.
 - b. Furnish one (1) word and picture signs for men and women accessible restrooms equal to BEST No. WP287RB and WP288RB.
 2. Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally.
 3. At signage required to have changeable name insert, provide window to contain insert.
- B. Exterior Multiple Message Post and Panel Signs: See Drawings / all Landscaping sheets. Made from interchangeable metal tubes to accommodate multiple text messages. Horizontal members will be screen printed with text as described hereinafter. Furnish extruded aluminum planks which can be removed for applying new messages. Planks are constructed of a 4" (102) high by 2" (51) thick extrusion, and can be stacked in any number. Maximum length limitation is 8' (2.44m). Length shall be minimum dimension as required to accommodate text messages. Support posts are 3 1/4" x 2 1/2" (83 x 64) in 8' (2.44m) length. Components will be furnished in custom painted colors as selected by Architect.
- C. Exterior Post & Panel Signature Text – Refer to drawings for post and panel signage schedule and text.

2.3 DIMENSIONAL LETTERS AND NUMBERS

- A. Cast Letters and Numbers: Form individual letters and numbers by casting. Produce characters with smooth, flat faces, sharp corners, and precisely formed lines and profiles, free from pits, scale, sand holes, or other defects. Cast lugs into the back of characters and tap to receive threaded mounting studs. Comply with requirements indicated for finish, style, and size.
1. Metal: Aluminum.
 2. Letter Height: 8 inches.
 3. Letter Style: Times Roman 209
 3. Copy: As shown on drawings

2.4 CAST METAL PLAQUES

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Plaques: Castings shall be free from pits, scale, sand holes, or other defects. Comply with requirements specified for metal, border style, background texture, and finish and with requirements shown for thickness, size, shape, and copy. Hand-tool and buff borders and raised copy to produce the manufacturer's standard satin polished finish. Refer to "Finish" article for other finish requirements.
1. Metal: Aluminum.
 2. Border Style: Raised flat band.
 3. Background Texture: Manufacturer's standard leatherette finish.
 4. Background Finish: Provide the manufacturer's standard baked enamel finish.
 5. Size: 24" x 36"

2.5 PROJECT CONSTRUCTION SIGNAGE

- A. Contractor shall provide Project Construction Sign in 4'x8' size (minimum) consisting of 3/4" exterior grade treated plywood backer with Coroplast signage board consisting of printed graphics to be provided by the Architect. The Construction Sign shall be mounted on minimum 4x4 treated posts with support frame to accommodate the sign construction. The 4x4 treated posts shall be embedded in the soil a minimum of 1/3 of the total length of the exposed height of the posts.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.
1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.
- B. Wall Mounted Braille Panel Signs: Attach panel signs to wall surfaces using the methods indicated below:
1. Silicone-Adhesive Mounting: Use liquid silicone adhesive recommended by the sign manufacturer to attach sign units to irregular, porous, or vinyl-covered surfaces. Use double-sided vinyl tape where recommended by the sign manufacturer to hold the sign in place until the adhesive has fully cured.
 2. Shim Plate Mounting: Provide concealed aluminum shim plates 1/8 inch thick, with predrilled and countersunk holes, at locations indicated and where other mounting methods are not practicable. Attach the plate with fasteners and anchors suitable for secure attachment to the substrate. Attach panel sign units to the plate using the method specified above.
- C. Bracket-Mounted Units: Provide the manufacturer's standard brackets, fittings, and hardware as appropriate for mounting signs that project at right angles from walls and ceilings. Attach brackets and fittings securely to walls or ceilings with concealed fasteners and anchoring devices to comply with manufacturer's directions.
- D. Dimensional Letters and Numbers: Mount letters and numbers using standard fastening methods recommended by the manufacturer for letter form, type of mounting, wall construction,

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

and condition of exposure indicated. Provide heavy paper template to establish letter spacing and to locate holes for fasteners.

1. Flush Mounting: Mount letters with backs in contact with the wall surface.
- E. Cast Metal Plaques: Mount plaques using the standard method recommended by the manufacturer for the type of wall surface indicated.
1. Concealed Mounting: Mount the plaques by inserting threaded studs into tapped lugs on the back of the plaque. Set in predrilled holes filled with quick-setting cement.
 2. Face Mounting: Mount plaques using exposed fasteners with rosettes attached through the face of the plaque into the wall surface.
- F. Exterior Post and Panel Signage: Install in 12" \varnothing 36" deep sonotube concrete cast in place footing with beveled conical top.

3.2 CLEANING AND PROTECTION

- A. At completion of the installation, clean soiled sign surfaces in accordance with the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

END OF SECTION 10 14 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 10: SPECIALTIES
Section 10 20 00: Louvers and Vents

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Fixed metal wall louvers. (See Mechanical and Architectural Louver Schedules. Cross reference these schedules for full scope of this Item).
 - 2. Wall vents (brick vents).
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 7 Section "Joint Sealants" for sealants installed in perimeter joints between louver frames and adjoining construction.
 - 2. Division 8 Section "Standard Steel Doors and Frames" for louvers in hollow metal doors and frames.
 - 3. Division 8 Section "Flush Wood Doors" for louvers in wood doors.
 - 4. Division 9 Section "Painting" for field painting louvers.
 - 5. Division 15 Section "Metal Ductwork" for ductwork connected to metal wall louvers.

1.3 DEFINITIONS

- A. Louver Terminology: Refer to Air Movement and Control Association (AMCA) 501 for definitions of terms for metal louvers not otherwise defined in this Section or in referenced standards.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Engineer, fabricate, and install exterior metal wall louvers to withstand the effects of loads and stresses from wind and normal thermal movement without evidencing permanent deformation of louver components including blades, frames, and supports; noise or metal fatigue caused by louver blade rattle or flutter; or permanent damage to fasteners and anchors.
 - 1. Wind Load: Uniform pressure (velocity pressure) of 20 lbf per sq. ft. (960 Pa), acting inwards or outwards.
 - 2. Normal thermal movement is defined as that resulting from the following maximum change (range) in ambient temperature. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.
 - a. Temperature Change (Range): 100 deg F (56 deg C).
- B. Air-Performance, Water-Penetration, and Air-Leakage Ratings: Provide louvers complying with performance requirements indicated as demonstrated by testing manufacturer's stock units of

height and width indicated. Test units according to AMCA 500.

1. Perform testing on unpainted, cleaned, degreased units.
2. Perform water-penetration testing on louvers without screens.
3. Equivalent Air-Performance Ratings: Louvers having less free area than that specified or having a lower free area velocity at the static pressure loss specified may be considered for the Work provided their total air performance is equivalent to that specified. The burden of proof of equivalency is on the Contractor. For louvers to be considered equivalent, the product of their free area, for the size specified, and their free area velocity at the static pressure loss specified must be at least equal to the product of the specified free area and velocity. Also, their free area velocity at the static pressure loss specified must not result in water penetration of more than 0.01 oz. per sq. ft. (3.1 g/sq. m) of free area, and they must meet all other requirements.

1.5 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract.
- B. Product data for each type of product specified.
- C. Shop drawings of louver units and accessories. Include plans, elevations, sections, and details showing profiles, angles, and spacing of louver blades; unit dimensions related to wall openings and construction; free areas for each size indicated; profiles of frames at jambs, heads, and sills; and anchorage details and locations.
 1. For installed products indicated to comply with certain design loadings, include structural analysis data sealed and signed by the qualified professional engineer who was responsible for their preparation.
- D. Samples for initial selection in the form of manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes.
- E. Samples for verification of each type of metal finish required, prepared on samples of same thickness and material indicated for final unit of Work. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
- F. Product test reports evidencing compliance of units with performance requirements indicated.
- G. Product certificates signed by louver manufacturers certifying that their products comply with the specified requirements and are licensed to bear the AMCA seal based on tests made according to AMCA 500 and complying with the AMCA Certified Ratings Program.
- H. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience.

1.6 QUALITY ASSURANCE

- A. Single-Source Responsibility: Obtain louvers and vents from one source and by a single manufacturer where alike in one or more respects regarding type, design, and factory-applied color finish.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. Welding Standards: Comply with applicable provisions of D1.2 "Structural Welding Code--Aluminum," and D1.3 "Structural Welding Code--Sheet Steel."
- C. Engineer Qualifications: A professional engineer legally authorized to practice in the jurisdiction where the Project is located and experienced in providing engineering services of the kind indicated that have resulted in the installation of louvers similar to this Project in material, design, and extent and that have a record of successful in-service performance.
- D. SMACNA Standard: Comply with SMACNA "Architectural Sheet Metal Manual" recommendations for fabrication, construction details, and installation procedures.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Check actual louver openings by accurate field measurements before fabrication and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Where field measurements cannot be made without delaying the Work, guarantee opening dimensions and proceed with fabricating louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Louvers:
 - a. Airline Products Co.
 - b. Airolite Co.
 - c. Airstream Products Div., Penn Ventilator Co., Inc.
 - d. All-Lite Louver Co.
 - e. American Warming and Ventilating, Inc.
 - f. Arrow United Industries.
 - g. Construction Specialties, Inc.
 - h. Greenheck Fan Corp.
 - i. Industrial Louvers, Inc.
 - j. Reliable Metal Products, Div. of Hart & Cooley, Inc.
 - k. Ruskin Mfg., Tomkins Industries, Inc.
 - 2. Metal Wall Vents and Soffit vents:
 - a. Airline Products Co.
 - b. Airolite Co.
 - c. Airstream Products Div., Penn Ventilator Co., Inc.
 - d. All-Lite Louver Co.
 - e. American Warming and Ventilating, Inc.
 - f. Arrow United Industries.
 - g. Construction Specialties, Inc.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- h. Greenheck Fan Corp.
- i. Industrial Louvers, Inc.
- j. Reliable Metal Products, Div. of Hart & Cooley, Inc.
- k. Riesner Vent Brick Corp.
- l. Ruskin Mfg., Tomkins Industries, Inc.
- m. Sunvent Industries, Sylro Sales Corp.

2.2 MATERIALS

- A. Aluminum Extrusions : ASTM B 221 (ASTM B 221M), Alloy 6063-T5 or T-52.
- B. Fasteners: Of same basic metal and alloy as fastened metal or 300 series stainless steel, unless otherwise indicated. Do not use metals that are corrosive or incompatible with joined materials.
 - 1. Use types and sizes to suit unit installation conditions.
 - 2. Use Phillips flat-head screws for exposed fasteners, unless otherwise indicated.
- C. Anchors and Inserts: Of type, size, and material required for type of loading and installation indicated. Use nonferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or expansion bolt devices for drilled-in-place anchors.

2.3 FABRICATION, GENERAL

- A. General: Fabricate louvers and vents to comply with requirements indicated for design, dimensions, materials, joinery, and performance.
- B. Assemble louvers in shop to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Maintain equal louver blade spacing to produce uniform appearance.
- D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances of louvers, adjoining construction, and perimeter sealant joints.
- E. Include supports, anchorages, and accessories required for complete assembly.
- F. Provide sill extensions and loose sills made of same material as louvers where indicated or required for drainage to exterior and to prevent water penetrating to interior.
- G. Join frame members to one another and to fixed louver blades as follows, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary:
 - 1. With fillet welds, concealed from view; or mechanical fasteners; or a combination of these methods; as standard with louver manufacturer.

2.4 FIXED, EXTRUDED-ALUMINUM WALL LOUVERS

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Horizontal, Drainable, Fixed-Blade Louvers: Extruded-aluminum frames and louver blades, designed to collect and drain water to exterior at sill by means of gutters in front edges of blades and channels in jambs and mullions, complying with the following requirements:
1. Louver Depth: 4 inches (100 mm), unless otherwise indicated.
 2. Frame Thickness: 0.125 inch (3.18 mm), unless otherwise indicated.
 3. Blade Thickness: 0.125 inch (3.18 mm), unless otherwise indicated.
 4. Blade Angle: 45 degrees, unless otherwise indicated.
 5. Performance Requirements: As follows, determined by testing units 48 inches (1220 mm) wide by 48 inches (1220 mm) high per AMCA 500:
 - a. Free Area: Not less than 7.50 sq. ft. (0.697 sq. m).
 - b. Static Pressure Loss: Not more than 0.14-inch wg (35 Pa) at an airflow of 900 fpm (4.57 m/s) free area intake velocity.
 - c. Water Penetration: Not more than 0.01 oz. per sq. ft. (3.1 g/sq. m) of free area at an airflow of 900 fpm (4.57 m/s) free area velocity when tested for 15 minutes.
 6. AMCA Seal: Mark units with the AMCA Certified Ratings Seal.

2.5 WALL VENTS (BRICK VENTS)

- A. Extruded-Aluminum Wall Vents: Extruded-aluminum louvers and frames not less than 0.125-inch (3.18 mm) thick and assembled by welding; with 18-by-14 (1.4-by-1.8-mm) mesh aluminum insect screening on inside face; incorporating weepholes, continuous drip at sill, and integral waterstop on inside edge of sill; of load-bearing design and construction. Color shall match color of wall system in which it is installed.

2.6 FINISHES, GENERAL

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes.
- B. Louvers shall receive Kynar 500 finish color coating applied following thorough cleaning and pretreatment. Kynar Finish color shall match adjacent material as selected by Architect and confirmed on submittals. Cleaning includes complete submersion in alkali cleaner, detergent deoxidation, amorphous chrome phosphate conversion coating and acidulated final rinse.
- C. Kynar, or equal, shall be applied to provide approximately 1.2 mils (.03) total dry thickness when baked at 450°F (232° C) for 10 minutes. The finish coating shall meet or exceed AAMA specification 2605 "Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels." Colors shall be as selected from full range of manufacturer's standard colors and shall closely match and compliment colors of wall materials into which louvers are installed.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3.2 INSTALLATION

- A. Locate and place louver units' plumb, level, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Repair finishes damaged by cutting, welding, soldering, and grinding operations required for fitting and jointing. Restore finishes so there is no evidence of corrective work. Return items that cannot be refinished in the field to the shop, make required alterations, and refinish entire unit, or provide new units.
- F. Install concealed gaskets, flashings, joint fillers, and insulation, as louver installation progresses, where required to make louver joints weathertight. Comply with Division 7 Section "Joint Sealants" for sealants applied during installation of louver.

3.3 ADJUSTING AND PROTECTION

- A. Protect louvers and vents from damage of any kind during construction period including use of temporary protective coverings where needed and approved by louver manufacturer. Remove protective covering at time of Substantial Completion.
- B. Restore louvers and vents damaged during installation and construction period, so that no evidence remains of correction work. If results of restoration are unsuccessful, as judged by Architect, remove damaged units and replace with new units.
 - 1. Clean and touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

3.4 CLEANING

- A. Periodically clean exposed surfaces of louvers and vents that are not protected by temporary covering to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Rinse surfaces thoroughly and dry.

END OF SECTION 10 20 00

MEDICAL, PSYCHIATRIC,
MINIMUM SECURITY HOLDING UNITS
ADDITIONS TO THE TUSCALOOSA COUNTY JAIL
TUSCALOOSA, ALABAMA

DIVISION 10: SPECIALTIES
Section 10 28 00: Toilet and Bath Accessories

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section.

1.2 SUMMARY

- A. This Section includes standard toilet and bath accessory items as scheduled.
- B. Security Toilet and Bath Accessories are specified in Division 11, Section 11010.

1.3 SUBMITTALS

- A. General: Submit the following according to Specific Conditions of the General Contractor.
- B. Product data for each toilet accessory item specified, including construction details relative to materials, dimensions, gages, profiles, mounting method, specified options, and finishes.
- C. Samples of each toilet accessory item to verify design, operation, and finish requirements. Acceptable full-size samples will be returned and may be used in the Work.
- D. Schedule indicating types, quantities, sizes, and installation locations (by room) for each toilet accessory item to be provided for project.
- E. Setting drawings where cutouts are required in other work, including templates, substrate preparation instructions, and directions for preparing cutouts and installing anchorage devices.
- F. Maintenance instructions including replaceable parts and service recommendations.

1.4 QUALITY ASSURANCE

- A. Single-Source Responsibility: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise acceptable to Architect.

1.5 PROJECT CONDITIONS

- A. Coordination: Coordinate accessory locations, installation, and sequencing with other work to avoid interference with and ensure proper installation, operation, adjustment, cleaning, and servicing of toilet accessory items.

MEDICAL, PSYCHIATRIC,
MINIMUM SECURITY HOLDING UNITS
ADDITIONS TO THE TUSCALOOSA COUNTY JAIL
TUSCALOOSA, ALABAMA

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 0.034-inch (22-gage) minimum thickness.
- B. Mirror Glass: Nominal 6.0-mm (0.23-inch) thick, conforming to ASTM C 1036, Type I, Class 1, Quality q2, and with silvering, electro-plated copper coating, and protective organic coating.
- C. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.
- D. Fasteners: Screws, bolts, and other devices of same material as accessory unit, or of galvanized steel where concealed.
- E. Keys: Unless otherwise indicated, provide universal keys for access to toilet accessory, units requiring internal access for servicing, resupply, etc. Provide minimum of six (6) keys to Owner's representative and obtain receipt.

2.2 ACCESSORIES

- A. Toilet/bath accessories except for detention type, shall be installed where shown on drawings and shall equal Bobrick, Bradley or American Dispenser co. Furnish and install the following or equal. Model No's unless otherwise shown are Bobrick. All are stainless steel unless otherwise shown. Item nos. indicated correspond with item nos. shown on accessory schedule on drawings. See attached Accessory Schedules.

- Item No. 1: Channel Frame Mirror – Bradley 781-1830 40”AFF to bot of reflective surface.
- Item No. 2: Surface Mounted Soap Dispenser – Bobrick -211 50”AFF to top of unit.
- Item No. 3: Surface Mounted Tower Dispenser-Bradley 250-15 40”AFF to bottom of unit.
- Item No. 4: Surface Mounted Multi Roll Toilet Tissue- Bobrick B2888 NIC -Provide Blocking. 28” AFF top of Unit
- Item No. 5: 18” Vertical Grab Bar 39-41” AFF
- Item No. 6: 36” Grab Bar 33-36” AFF
- Item No. 7: 42” Grab Bar 33-36” AFF

2.3 FABRICATION

- A. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Provide concealed anchorage wherever possible.
- B. Mirror Unit Hangers: Provide system for mounting mirror units that will permit rigid, tamperproof, and theft proof installation, as follows:
 - 1. Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

MEDICAL, PSYCHIATRIC,
MINIMUM SECURITY HOLDING UNITS
ADDITIONS TO THE TUSCALOOSA COUNTY JAIL
TUSCALOOSA, ALABAMA

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install toilet accessory units according to manufacturers' instructions, using fasteners appropriate to substrate as recommended by unit manufacturer. Install units plumb and level, firmly anchored in locations and at heights required.
- B. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to manufacturer's instructions for type of substrate involved.
- C. Install grab bars to withstand a downward load of at least 250 lbf+, complying with ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.
- B. Clean and polish all exposed surfaces strictly according to manufacturer's recommendations after removing temporary labels and protective coatings.

END OF SECTION 10 28 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 10: SPECIALTIES
Section 10 44 00: Fire Extinguishers, Cabinets, and Accessories

PART 1 - GENERAL

A. RELATED DOCUMENTS

1. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and specific requirements apply to this section.

B. SUMMARY

1. This Section includes the following:
 - a. Fire extinguishers.
 - b. Fire extinguisher cabinets.

1.3 QUALITY ASSURANCE

- A. UL-Listed Products: Fire extinguishers shall be UL listed with UL listing mark for type, rating, and classification of extinguisher.

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHERS

- A. General: Provide fire extinguishers for each cabinet and other locations indicated, in colors and finishes selected by Architect from manufacturer's standard, that comply with authorities having jurisdiction.
1. Fill and service extinguishers to comply with requirements of governing authorities and manufacturer.
- B. Multipurpose Dry Chemical Type: UL-rated 2-A:10:B:C, 5-lb nominal capacity, in enameled steel container. Use everywhere except kitchen.
- C. Carbon Dioxide Type: UL – Rated 5-B:C, 5lb. nominal capacity in enameled steel container. Use at kitchen.

2.2 CABINETS

- A. General: Provide fire extinguishers cabinets where required, of suitable size for housing fire extinguishers of types and capacities indicated.
1. 24"x9" Detention Cabinet for 10lb ABC Fire Extinguisher – Steel Door and Frame, Surface Mount, Mechanical security lock.
- B. Construction: Manufacturer's standard detention enameled steel box with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- C. Cabinet Type: Suitable for containing the following:
 - a. Fire extinguisher.
- D. Cabinet Mounting: Suitable for the following mounting conditions:
 - 1. Surface Mount Detention Cabinet
- E. Door Material and Construction: Manufacturer's standard door construction, of material indicated, coordinated with cabinet types and trim styles selected.
 - 1. Enameled Steel: Heavy gauge, one piece solid steel door with matching trim and heavy gauge continuous piano hinges.
- F. Identify fire extinguisher in cabinet with FIRE EXTINGUISHER lettering applied to door. Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location.
 - 1. Application Process: Silk screen.
- G. Door Style: Manufacturer's standard design.
 - 1. Solid Panel: Full flush heavy gauge steel.
- H. Door Hardware: Mechanical Security locks. Provide concealed or continuous-type hinge permitting door to open 180 deg.

PART 3 - EXECUTION

C. INSTALLATION

- A. Install in locations and at mounting heights indicated or, if not indicated, at heights to comply with applicable regulations of governing authorities.
 - a. Prepare wall surface for cabinets as required by type and size of cabinet and style of trim and to comply with manufacturer's instructions.
 - b. Fasten mounting brackets and cabinets to structure, square and plumb.

END OF SECTION 10 44 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH ./ MEDICAL UNIT
ANNISTON, ALABAMA

SECTION 11 19 00 DETENTION SURFACE PADDING SYSTEM

PART I GENERAL

1.1 SECTION INCLUDES

- A. Surface padding system for floors, walls, doors and frames of detention spaces.

1.2 RELATED SECTIONS

- A. Division 8: Doors and frames.

1.3 PERFORMANCE AND DESIGN REQUIREMENTS

- A. Provide detention surface padding system which isolates detainees from hard surfaces within the scheduled detention area.
 - 1. Padded surface system shall resist chipping and peeling.
 - 2. Padded surface system shall be easy to clean.
 - 3. Padded surface system shall be water-repellent, impervious to oil, urine and salt.

1.4 QUALITY ASSURANCE

- A. Comply with governing codes and regulations.
- B. Applicator Qualifications: Application shall be performed by an applicator with a minimum of 5 years experience in the successful fabrication and installation of detention surface padding system.
- C. Deliver, handle and store materials in accordance with manufacturer's instructions.
- D. Surface burning characteristics of detention surface system when tested in accordance with UL Standard 723 (ASTM E84) must be equal to or less than:
 - 1. Flame Spread Index 10
 - 2. Fuel Contributed 10
 - 3. Smoke Developed 160
- E. Compression Deflection (ASTM D 1056) 4 psi @ 25 % deflection.
- F. Acute Oral Toxicity Test..... Non Toxic
- G. Fungus Resistance(ASTM G-21-90) 0 (Completely resistance)
- H. CSS 12-100-1 Corner Test Pass

1.5 SUBMITTALS

1.6

- A. Product Data: Submit manufacturer's product data and installation instructions. Include methods of installation of surface padding system for each type of substrate to receive padding.
- B. Shop Drawings: Submit shop drawings showing typical method of padding application.
- C. Maintenance Information: Submit, for Owner's use, information regarding the proper care and maintenance of detention surface padding system.
- D. This product is "Basis of Design" or prior approved equivalent. Follow prior approval request requirements prior to bid.

1.7 WARRANTY

11190-3

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
 MENTAL HEALTH ./ MEDICAL UNIT
 ANNISTON, ALABAMA

- A. New Installations: A padded surface installed by Padded Surfaces by B&E is guaranteed impenetrable by organic human body parts for a period of three years from date of manufacturer's installation approval for use. Should penetration occur, the damage will be repaired or the surface replaced at the manufacturer's option.
- B. Conditions: This guarantee does not apply to damage caused by non-organic human body parts, nor damage resulting from use prior to completion of final curing. This product is not intended to replace established management practices, but to supplement those practices, while allowing for a greater degree of protection against client self-injury.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Provide detention padded surface system fabricated by, Basis of Design or prior approved equivalent:
 Padded Surfaces by B&E

2.2 MATERIALS

- A. Foam Sheets: MFSiltec-500
 - 1. Features
 - a. Nonflammable, nontoxic, and inherently durable
 - b. A nonconductive foam polymer with excellent cushioning, fire blocking, thermal insulating and acoustic/vibration dampening properties
 - c. Structurally resilient with low compression set and 100% memory
 - d. Continuous operating temperature range: -70 to +500 degrees F.
 - e. MFSiltec is odorless, tasteless and non corrosive
 - 2. Specifications:
 - a. ASTM D 3674 & E 162... Pass
 - b. UL-94... V-O
 - c. California Technical Bulletin 117... Pass
 - d. FMVSS 302... Pass
 - e. ASTM E662 (Flaming Mode) Ds @ 1.5 min. < 50
 - f. ASTM E662 (Non Flaming Mode)..... Ds @ 4 min. < 100
 - g. Bombardier SMP 800-C Pass
 - h. ASTM D573 Pass
 - 3. Compression Set, % ASTM D-1056 22 hours @ 100 C...5 %
 - 4. Compression Deflection, psi @ 25 % 4 psi.
 - 5. Tensile Strength, psi 25 psi minimum
 - 6. Elongation, % 60 % minimum
 - 7. Water Absorption, % 10 % maximum
 - 8. Thermal Conductivity k Factor 0.30 (BTU in/hr/ft./F)
- B. Reinforcing Mesh: Kevlar bullet resistant material
 - 1. Tensile Strength (Average) ,000 psi
 - 2. Elongation at break 10 %
- C. Encapsulate: High-build liquid vinyl of consistency to permit spray or field application.
- D. Architect's color choice
- E. Adhesive: Type compatible with the materials to be adhered.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH ./ MEDICAL UNIT
ANNISTON, ALABAMA
PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which detention surface padding system is to be applied. Verify that substrate is in proper condition for installation of system. Do not proceed with installation until satisfactory conditions have been corrected.

3.2 PREPARATION

- A. Verify that ambient temperatures will be within range required by manufacturer for successful installation and curing of system.
- B. Verify that work of other trades are complete and will not adversely affect curing and protection of detention surface padding system.

3.3 INSTALLATION ON WALLS AND FLOORS

- A. Cover specified areas with Kev-Koat padded material system.
- B. Apply protective top coat to encapsulate entire padded surface. Color as selected by Architect.
- C. If the application is new construction a sixty day curing time is necessary for the concrete floor.
- D. Temperature must be 60 degrees Fahrenheit at time of installation and maintained for the duration of the construction period and 30 day cure time.
- E. At penetrations of padding system for plumbing fixtures, air diffusers, lighting fixtures and security devises, coordinate with requirements of the respective trades for correct mounting.
- F. A 30-day cure time is required before rooms with detention surface padding can be utilized. Use prior to the 30-day cure time will void the 3 year warranty.

3.4 DOOR PADDING PANEL FABRICATION

- D. Fabricate components to comply with performance and design requirements specified and in accordance with approved shop drawings.
- E. Door padding panels shall be composed of Kev-Koat padded material system adhered to a 3/4" thick fire resistant plywood backing board.
- F. Provide openings for glazed observation openings and food slots.

3.5 CLEANING AND PROTECTION

- A. Touch up damage.
- B. Clean work area of debris associated with installation.
- C. Surface can be cleaned with a mild, non-abrasive liquid detergent.

END OF SECTION

11 19 00-3

SECTION 11 80 00
LAUNDRY EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTIONS

A. DEFINITIONS

1. The extent of the Laundry Equipment is shown on the drawings, equipment schedule, and specification of this Section of Contract Documents.
2. The plans indicate the location of the equipment, and slight changes due to the varying dimensions of equipment and wall construction will be permitted with approval by the Architect.
3. This typed Specification will be closely correlated with the Drawings and Schedule. Each complements the other and cross reference will be necessary to fulfill the requirements of the Specifications, all information shown on Drawings and listed in schedules shall be incorporated as part of the written Specifications.
4. Conflict in plans and specifications where changes, alterations, additions, or deductions are necessary, or where exceptions are taken with regard to sizes, locations, and other details shown on plans, shall be reported for decision by the Architect.
5. Contractor shall be responsible in seeing that the equipment can be entered through openings before doors and walls are finished.

B. INTERFACE

1. Building Contractor shall furnish all water lines and other necessary work as specified in Mechanical Sections, including final connections to equipment.
2. Building Contractor shall furnish all electrical supply lines and other work as specified in Electrical Sections, as well as making final connections to equipment.
3. Building Contractor shall furnish all ducts to exhaust fan as specified in (HVAC) Mechanical Sections, including those specified in this section of Specifications.
4. Building Contractor shall furnish all faucets, special switches, valves, traps, labor and materials to make final connection to equipment, as so specified in other sections of the Architect's Contract Specifications, unless specifically pecified herein this section.

C. PERFORMANCE

1. At the start of operation of equipment, devote one full working day, showing personnel the operation and adjusting of equipment supplied. Supply the Architect with an affidavit, signed by Owner(s) and laundry manager, that this service was rendered and performed.

1.2 QUALITY ASSURANCE

- A. Permits and Certificates: All laws, codes, ordinances and regulations bearing on the conduct of the work as drawn and specified shall be complied with by The Laundry Equipment Contractor and he shall give all notices required. Any work upon which an inspection certificate by local authorities, and/or any governing body is required, such inspection certificate or certificates shall be obtained and paid by Owners.
- B. Certificates of acceptance or of completion as required and issued by the State, Municipal, or other authorities shall be procured and delivered to the Owner; and the Owner may withhold payments which are due or which may become until the necessary certificates are procured and delivered to him.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- C. Safety devices required to comply with the aforementioned regulations shall be furnished, regardless of whether or not specifically specified or called for in the following technical divisions of the equipment list schedule.
- D. Where applicable electrical equipment shall conform to the standards of the National Electrical Manufacturer's Association, this equipment shall have conveniently located control switches, enclosed case type, and shall comply with State of Alabama Electric Codes and bear the UL or approved Electrical Testing Laboratory (ETL) label.
- E. Electrically heated and motor driven fixtures shall be for the current shown in the Mechanical and Electrical plans, and these items of equipment shall have mounted motor starters, switches and controls. All shall be required for each fixture or complete section of a fixture, or as specified.
- F. Gas burning equipment shall be designed for operation with the type of gas supplied, and shall be approved by the American Gas Association. The label or listing of the American Gas Association will be accepted as conforming to this requirement. Installation of equipment shall conform to the standards as set forth by the American Gas Association. All gas equipment shall be furnished with electronic ignition or with safety pilot and one hundred percent safety cut-off protection where required.
- G. Contractor shall be held responsible and liable for any and all changes or variances from Contract Documents, i.e. Plans, Specs, Addendums, without written authorization from Architect for said changes or variances.

1.3 REFERENCES

- A. The drawings indicate the desired basic arrangement and dimensions of the equipment; minor deviation therefrom may be substituted for approval provided basic requirements are met and no major rearrangement of services to the equipment is required to affect the proposed alteration. Such deviations shall be made without expense to the Owners. Should there be any questions, Architects shall be contacted for written instructions.
- B. Contractor shall be responsible for the satisfactory operation of the assembled equipment. Tests of the installed equipment shall be required. Defects or deficiencies noted as a result of tests shall be corrected at the expense of the Contractor. Consult the mechanical and electrical drawings and their accompanying specifications to determine additional requirements of the work, and shall cooperate with all trades to insure a completely satisfactory installation. Verify all electrical requirements from electrical plans and specifications.

1.4 SUBMITTALS

- A. GENERAL: Submit in accordance with Section 01300-Submittals.
- B. SHOP DRAWINGS: Verify all field measurements on the job site to insure proper fitting of all equipment. Submit to the Architects for their approval drawings showing and giving detailed information of mechanical and electrical service lines, each on separate sheets. At the same time, submit complete brochures, cuts, and technical data of manufactured items he is furnishing for the Architect's approval. Submit to the Architect shop drawings, drawn to a scale of not less than 3/4" equal to 1'0" for all special fabricated items such as custom-built work tables, sinks, equipment and other special fabricated equipment.
- C. Partial submittals will not be allowed.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1.5 DELIVERY, STORAGE AND HANDLING

- A. All equipment herein specified shall be delivered to job site, uncrated, assembled and set in proper area; ready for final connections, where required, as specified in Sections 15 and 16 of Contract Documents.
- B. Protect metal finishes from damage during shipping storage, handling, installation and construction of other work in the same spaces. Wrap and crate each item of equipment as needed for protection from damage.

1.6 SEQUENCE/SCHEDULING

- A. SCHEDULES AND REPORTS: Establish earliest and latest job site delivery dates of Owner furnished and Contractor installed items.

1.7 WARRANTY

- A. WORKMANSHIP AND GUARANTEES: All material as specified shall be new, of the best quality, perfect, and without flaw. Equipment shall be delivered in an undamaged condition upon completion. All workmanship and labor shall be of the best in their respective field and skilled mechanics of the trades involved.
- B. All equipment as specified herein this Section shall be guaranteed for a period of one year from the time of Substantial Completion. If at any time within this warranty period of one year any items of equipment that is found to be faulty due to poor workmanship, or inferior, and/or defective materials, replace said pieces or correct each defective part at no cost to Owner.

1.8 SUBSTITUTION

- A. SUBSTITUTION OF MATERIALS AND EQUIPMENT: Whenever a material, article, or piece of equipment is identified on the Drawings or in the Specifications by reference to manufacturers' or vendors' names, trade names, catalog numbers, or the like, it is so identified for the purpose of establishing a standard. And any material, article, or piece of equipment of other manufacturers or vendors which will perform adequately the applications required by the general design will be considered equally acceptable provided, in the opinion of the Architects, it is of comparable substance, appearance and function. It shall not be purchased or installed without the proper written approval. All substitutes shall be submitted for approval at least 10 days before Bid Date.

PART 2 - PRODUCTS

2.1 EQUIPMENT LIST

- a. Eagle Group Model No. HSA-10-F*C013
- b. Hand Sink, wall mount, 13-1/2" wide x 9-3/4" front-to-back x 6-3/4" deep bowl, 304 stainless steel construction, splash mount gooseneck faucet, basket drain, deep drawn seamless design-positive drain, inverted "V" edge, NSF
- 2. SOAK SINK
 - a. Provide supertough floor mounted Soak Sink, Model No. 17F, manufactured by Mustee. Provide unit with standard finish and equipment.
 - b. Provide unit with Faucet-clamp on heavy brass body with swing spout and hose end, Part No. 90.770.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. LAUNDRY STORAGE SHELVING
 - a. Metro Model No. 2148BR*C013
 - b. Super Erecta® Shelf, wire, 48"W x 21"D, Brite (zinc) finish, plastic split sleeves are included in each carton, NSF
 - c. 5 ea 2142BR Super Erecta® Shelf, wire, 42"W x 21"D, Brite (zinc) finish, plastic split sleeves are included in each carton, NSF
 - d. 5 ea 2136BR Super Erecta® Shelf, wire, 36"W x 21"D, Brite (zinc) finish, plastic split sleeves are included in each carton, NSF
 - e. 12 ea 86P Super Erecta® SiteSelect™ Post, 86-1/2"H, adjustable leveling bolt, posts are grooved at 1" increments & numbered at 2" increments, double grooved every 8", chrome finish
 - f. Each shelving unit is to be made of 5 shelves and 4 posts.

4. SOILED LINEN CART
 - a. Provide Soiled Linen Cart Model No. 40070016, manufactured by Dandux. Provide three nonremovable plastic shelves

5. CLEAN LINEN CART
 - a. Provide mobile Delivery Cart, Model No. 51-2301, manufactured by Dandux Co. Two casters shall be provided with brake device.
 - b. Truck shall be provided with push/pull bars on each end.
 - c. Architect is to select color of trucks during the submittal stage. Manufacturer to submit standard color chart for Architect selection.

6. 45 LB WASHER
 - a. Unimac UWN045T4V
 - b. 45 Lb Capacity
 - c. 7.3 Cylinder volume
 - d. 5 HP (3.7) Motor size
 - e. 9 Totalnumber of speeds
 - f. 3" Drain diameter
 - g. 1 @3/4 Water inlet connection

7. 65 LB WASHER
 - a. Unimac UWN065T4V
 - b. 65 Lb Capacity
 - c. 9.7 Cylinder volume
 - d. 5 HP (3.7) Motor size
 - e. 9 Totalnumber of speeds
 - f. 3" Drain diameter
 - g. 4 @3/4 Water inlet connection

8. 75 LB DRYER
 - a. Unimac UTF75N
 - b. 75 Dry weight capacity
 - c. ¾ Motor
 - d. (1) ¾"-11 ½" NH Hose connection

PART 3 - EXECUTION

3.1 DEMONSTRATION AND INSTRUCTION BOOKLETS:

- A. At such time as designated by the Architect or Owner(s), demonstrate to proper personnel the use, care, and maintenance of equipment.
- B. Submit to Owner at time of demonstrations complete booklets, in hard binders, containing instructions, warranties, and parts list of all bought out items furnished under this section.
- C. Include in the binders a list of names, addresses and telephone numbers of local servicing agencies authorized to make necessary repairs and/or adjustments of the equipment furnished under this Section of Contract Documents.

3.2 INSTALLATION

- A. Laundry Equipment shall be delivered to job site, freight prepaid.
- B. Uncrate, assemble and install, or erect where required, all items of Laundry Equipment. Shall connect such items, as necessary for use, to building utility systems. The final hook-up and equipment connections shall be made by the project's Plumbers, HVAC personnel and Electrician.
- C. Provide on-site testing of equipment. Shall make modifications or corrections as necessary for the intended operation and use of specified equipment.
- D. On completion of installation and testing, remove all packaging and debris from site, clean all items of equipment as recommended by manufacturer and leave equipment ready for use by Owners.
- E. Contractor shall have a competent laundry equipment foreman on the premises to assist in furnishing information to tradespersons and supervising installation of equipment under this section.

END OF SECTION 11 80 00

**SECTION 11 98 00
DETENTION EQUIPMENT**

DETENTION EQUIPMENT

PART 1 - GENERAL

1.01 DRAWINGS AND ANY GENERAL PROVISIONS OF THE CONTRACT FOR ALL BID ITEMS, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS SPECIFIC REQUIREMENTS APPLY TO THIS SECTION.

1.02 GENERAL REQUIREMENTS

- A. Work of this section shall be governed by the Contract Documents. Provide materials, labor, equipment and services necessary to furnish, deliver and install all work of this section as shown on the Drawings, as specified herein, and/or as required by job conditions and for full interface and operational functionality with other Divisions of this specification.

1.03 DESCRIPTION

- A. Glossary of Terms:
1. Detention Equipment Contractor (DEC)
 2. Electronic Security Contractor (ESC) - See Division 1728.
 3. Precast Concrete Module Contractor (PCMC) – See Division 13.
 4. Note: No Bidder will be permitted to integrate prices for Division 11 and Division 17 28 into a consolidated proposal. Any attempt to do the same will be justification for disqualification.
- B. Scope and Responsibility
1. A single separate Detention Contractor (DEC) having met all requirements listed in Quality Assurance 1.5 and having been approved by the Architect, shall assume complete control and accountability for furnishing and installing a complete Detention package as hereinafter specified.
 2. The DEC shall be responsible for the interfacing and integration of all products and systems with the separate ESC (Division 1728), General Contractor, and related subcontractors to ensure that all parts of the work will come together properly with his. The ultimate coordination for a complete working system shall be the responsibility of the DEC.
 3. The DEC's scope of the work shall include but not be limited to:
 - a. Furnish and install:
 - 1) Detention Hardware
 - 2) Detention Locking Devices and Operators
 - 3) Detention Hollow Metal Doors and Frames
 - 4) Security Glass and Glazing
 - 5) Security Mesh, Grating and Grilles
 - 6) Security Hollow Metal Fixed Windows
 4. Detention Equipment Contractor (DEC) and Electronic Security Contractor (ESC):
 - a. A single Detention Equipment Contractor (DEC) listed herein as pre-approved or having met all requirements listed hereafter and having been approved by addendum, shall assume control and accountability for furnishing and installing Detention Equipment.
 - b. The DEC shall be responsible for submitting an independent bid. A single separate Detention Contractor (DEC) –having met all requirements listed in Quality Assurance 1.5 and having been approved by the Architect, shall assume complete control and accountability for furnishing and installing a complete Detention package as hereinafter specified.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- c. The DEC shall be responsible for the interfacing and integration of all products and systems with the ESC (Division 1728), General Contractor, and related subcontractors to ensure that all parts of the work will come together properly with his. The ultimate coordination for a complete working system shall be the responsibility of the DEC.
 - d. The DEC shall be responsible for the integration and interfacing of the products and systems specified in this Section and in accordance with shop drawings and submittals which are approved by the Architect.
 - e. Furnish only for installation by General Contractor
 - 1) Detention Hollow Metal Door Frames and Sidelights
 - 2) Detention Borrowed Lights and Vision Panels.
 - 3) Detention Furnishings, Furniture and embeds (shown on drawings and specified herein to be part of this Contract).
 - 4) Security Access Doors & Panels.
 - 5) Hollow Metal Fixed windows.
 - 6) Security Mesh fabrications and framings.
- C. Interface and integrate all products and systems in compliance with 1.4 Systems Operational Description and coordinate fully with Division 17 28 subcontractor (ESC), and General Contractor for fully functional integrated system.

1.04 RELATED WORK SPECIFIED ELSEWHERE

- A. Standard hollow metal frames, doors, partitions, view windows, transoms and sidelights referred to hereinafter and, on the drawings, as general doors and builders' hardware.
- B. Furnishing and installing hardware for non-detention doors.
- C. All glass, other than security glass. Standard glazing - see section 08 80 00.
- D. Casework / Millwork if any required.
- E. Receiving, unloading, distributing, setting, and building in of all detention related embedded items. This includes bars, plates, angles, detention door frames and detention sidelights, and miscellaneous detention frames required by this Division. These items shall be furnished and installed by General Contractor.
- F. Caulking (Security and Standard).
- G. Field touch-up of prime coat.
- H. Finish painting.
- I. Final cleaning.
- J. Electrical work, except as specified herein.
- K. The ESC's scope of work shall generally include the following, but shall be defined in more detail hereafter:
 - 1. Furnish and install complete and operable integrated Security Electronic Control System as described in Division 17000 28 and depicted on the contract drawings.
 - 2. Touch Screen Interface Controls
 - 3. Programmable Logic Controllers (PLC)
 - 4. Metal equipment Cabinets, Racks, etc.
 - 5. Electronic Control Relay/Electronic Wiring
 - 6. Lightning/Surge Suppression
 - 7. Uninterruptible Power Supply System
 - 8. Operational Intercom and Paging System
 - 9. Vehicle Detection System
 - 10. Access Control Systems
 - 11. Closed Circuit Television (CCTV) Systems

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

12. 12) Inmate Call Switches
13. Watchtour Pushbutton System
14. Security Management System

1.05 SYSTEMS OPERATIONAL DESCRIPTION

- A. All electric locks, except as noted otherwise, shall be designed to retract the latchbolt, by either solenoid or motor operation for exterior and interior doors, or by motor operation for interior doors.
- B. All electric locks for general traffic doors will automatically extend the latchbolt on opening the door and automatically deadlock on closing.
- C. All electric locks for emergency exit and general traffic doors will be interfaced with Division 17 28 features, to allow the operator to unlock all the doors in the emergency release sequence as described.
- D. All electric locks will have mechanical override feature by means of a key at the door.
- E. All doors with electric locks shall have a door position switch.
- F. All detention hollow metal doors will be constructed with 12 gauge face plates at interior or as otherwise noted on schedule and 12 gauge face plates at exterior. All exterior hollow metal doors and frames (and those at shower rooms and exercise yards) shall be galvanized for painting. See schedule. All detention hollow metal door frames and interior detention hollow metal window frames will be constructed of 12 gauge steel grout filled as noted on schedule. See door and hollow metal view window schedules.
- G. Fixed detention hollow metal detention windows will be used for exterior windows as detailed and specified herein. Glazing as shown on glazing schedules.

1.06 QUALITY OF DETENTION EQUIPMENT CONTRACTOR

- A. Any DEC, not listed below, who intends to submit a bid on this section of the specifications shall submit the following pre-qualification data to the Architect in writing ten (10) days prior to bid date and shall be approved by Addendum prior to bid date.
- B. Evidence that this firm has a minimum of five (5) years' experience in successfully completing projects of equal scope and magnitude with products as herein specified. This evidence shall consist of a list of five (5) projects giving the name, location, and architects including person to contact and telephone number that have been complete and operational for a minimum of five (5) years.
- C. All materials and labor specified in this Section of the specifications shall be furnished by manufacturers specified herein or equals approved subject to the provisions of these specs.
- D. The following DEC's are pre-approved. Other DEC's requesting to be approved, must provide all the qualifications and conditions listed above in Section 1.5.
 1. C.A. Owens, Freeport, FL Phone (850) 835-7456
 2. Cornerstone Detention Products, Madison, AL Phone (256)340-2396
 3. Noah Detention, Destin, FL Phone (850) 279-3257
 4. Bruner Detention, Harrisonburg, VA Phone (540)908-4739
 5. U.S. Security, Montgomery, AL Phone (334) 273-8778NOTE: Approval of a firm as a DEC does not relieve that DEC from furnishing all materials from the manufacturers as herein specified or other equals receiving prior approval by written addendum.
 6. SECURITY ELECTRONIC CONTROL (SEC) System Integrators shall comply with Division 17000 28 Qualification Requirements.
 7. QUALIFICATIONS OF MANUFACTURERS: Throughout the specifications and drawings, types of materials may be specified by the manufacturer's name and catalog number in order to establish standards of quality and performance. If the bidder elects to substitute

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

and prove such equality, he must request the Architect's approval in writing ten (10) days prior to bid date. See below the submittal requirements for architectural approval for each type of product listed.

- E. Detention Equipment: Provide detention equipment products and items from manufacturers who have not less than 5 years successful experience with and shall now be actively engaged in the design and manufacturer of detention hardware of the type required for this project. All locks, locking devices, and associated detention hardware shall be provided by the same manufacturer unless so noted on drawings or scheduled herein.
- F. Submittal Requirements: In addition to a written request for equality, a full size sample or appropriate manufacturer's "engineering" cut sheet of each lock, locking device, and miscellaneous detention hardware item; full size details of each lock and device; performance data; catalog information; and a written list showing the names, locations, and Architects of a minimum of five (5) institutions for which similar materials have been installed for a period of five (5) years shall also be submitted. Special exceptions shall be addressed to Architect in writing.
- G. Detention Hollow Metal: Provide detention hollow metal products and items from manufacturers who have not less than five (5) years successful experience with and shall now be actively engaged in the design and manufacture of detention hollow metal doors and frames of the type required for this project. All detention hollow metal doors and frames shall be produced by the same manufacturer. All fire rated detention glazing units shall bear a UL label unless the opening is protected by a Fire Protection Wash as required by the International Building Code. Glass manufacturer/vendor, DEC, hollow metal manufacturer and the General Contractor shall all furnish within 24 hours of the time proposals are submitted affidavits, from each certifying that glazing components (glass and hollow metal in assembly) shall be capable of bearing a UL label as called for on each fire rated assembly. Non-compliance will constitute grounds for rejection of any General Contractors proposal. Any requirements necessary to meet the intent of this qualification after bidding shall be accomplished by the General Contractor & DEC at no cost to the owner including any sprinkler wash required to accommodate any opening rating. Hollow metal and glazing manufacturers will be held accountable for the assurance of this requirement.
- H. Submittal Requirements: In addition to a written request for equality, a full size corner sample or appropriate manufacturers engineering cut sheet of each type door and frame showing door construction, face stiffening, insulation, and top hinge reinforcements; details of each type of door and frame; performance data; catalog information; and a written list showing the names, locations, and Architects of a minimum of five (5) institutions for which similar materials have been installed for a period two (2) years shall also be submitted.
- I. Performance Tests: All detention hollow metal door manufacturers shall submit to the Architect an independent testing laboratory report certifying the following minimum performance of a typical detention hollow metal door. The test report shall include complete details on test apparatus used, testing procedures and results, and construction of test sample.
 - 1. Two full flush 12 gauge detention doors 3'-0" wide x 6'-8" high shall be prepared for hardware as follows:
 - a. Lock: The door shall be prepared to receive a Folger Adam 0 Series Lock or equal institutional lock using HM lock mounting, located at a height of 40-5/16" to centerline bolt. A 3/16" thick x 7" x 10" cover plate shall be prepared and mounted to the door per template.
 - b. Hinges: The edge of the door opposite the lock preparation shall be prepared for 1-1/2" x 4-1/2" institutional hinges. The spacing shall be 5" from the top of the door to the top of the first hinge, 10" from the bottom of the door to the bottom of the third hinge, and the middle hinge shall be equal spaced between the first and third hinges.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- c. The doors prepared for hardware shall be tested as follows: Static Load Test: One door shall be supported in the horizontal position no more than 2" from each end. A test load of 14,000 lbs. shall be applied equally distributed between the quarter points. The maximum deflection at center span under full load shall be recorded, and shall not exceed .578". The test door shall be permanently marked, dated and retained at the manufacturer's location for possible future reference or examination for a period of one year from date of job completion.
 - d. Twist Test: The other door shall be held in a stationary cantilevered position no more than 6" from the top. The lower corner on the hinge edge shall be supported by a stand whose door contact surface is no more than 6" x 6" square. A test load of 7,500 lbs. shall be applied in a downward direction to the unsupported corner.
 - e. Glass Stop Test: A rectangular view window test frame shall be constructed with a glass opening size of 28" x 33" (± 1 "). The frame shall be constructed of commercial quality steel meeting ASTM standard #A366 or #A569, 12 gauge maximum.
 - f. A steel plate of 3/8" minimum thickness shall be glazed in place using the specified glass stop method.
 - g. The test frame assembly shall then be rigidly fixed in the horizontal position with the removable glass stop on the lower side.
 - h. A target on the top side of the 3/8" plate shall be marked in one corner no more than 6" away from the stops.
 - i. An impact dart capable of developing up to 400 ft. lbs. of impact energy to the plate shall be positioned to strike the target.
 - j. Ten (10) impact blows of 400 lbs each shall be delivered to the target. The removable stop shall remain undamaged, and the 3/8" plate shall remain firmly in place. There shall be no more than one (1) broken fastener in the assembly after impact testing.
- J. Security Glass: Provide security glass products and items from manufacturers who have not less than two (2) years successful experience with and shall now be actively engaged in the design and fabrication of security glass of the type required for this project.
- K. Submittal Requirements: In addition to written request for equality, a 6 x 6 size sample of each type of glass; performance data; catalog information; and a written list showing the names, locations, and Architects of a minimum of five (5) institutions for which similar materials have been installed for a period of one (1) year shall also be submitted.
- L. Certification Requirements: In addition to written request for equality, a full size sample of each type of glass; performance data; catalog information; and a written list showing the names, location, and Architects of a minimum of five (5) institutions for which similar materials have been installed for a period of two (2) years shall also be submitted. All fire rated security glazing shall bear a UL label unless the applicable opening is protected by a Fire Protection Sprinkler Wash as required by the International Building Code. See Life Safety Drawings. Glass manufacturer/vendor DEC, hollow metal manufacturer and the General Contractor shall all furnish at the time proposals are submitted affidavits from each certifying that glazing components (glass and hollow metal in assembly) shall be capable of bearing a U.L. label as called for on each fire rated assembly. Non-compliance will constitute grounds for rejection of any General Contractors proposal. Any requirements necessary to meet the intent of this qualification after bidding shall be accomplished by the General Contractor & P.S.C. at no cost to the owner. Hollow metal and glazing manufacturers will also be held accountable for the assurance of this requirement.
- M. Laminates meet requirements of Z-26.1 ASI-AS9 for light, stability, luminous transmittance, bake, humidity, boil, weatherometer, dimensional stability, and impact. Composition of product has previously been approved and used by the Federal Bureau of Prisons, U.S. Department of Justice, as a clear security barrier for exterior perimeter transparent glazing over 5" in width. Send a copy of this approval along with certification letter.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- N. Security glass shall meet requirements of American National Standards Institute: ANSI Z-26.1-1966 (Revised 1973), Safety Code for Safety Glazing Materials for Glazing Motor Vehicles Operating on Land Highways: ANSI Z-97.1-1975, Breaksafe Characteristics; CPSC Federal Specification 16CFR-1201.
- O. Security glass shall meet requirements of the American Society for Testing and Materials. ASTM designation A635-77 Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics on a Horizontal Position.
- P. Security glass meets or exceeds the following tests as later described in detail in this Specification: Temperature Test; Drop Dart Test; Physical Attack Test; and Edge Disengagement Test.
- Q. Detention Hollow Metal Fixed Windows: Provide detention windows produced by hollow metal manufacturers who have not less than five (5) years successful experience with and shall now be actively engaged in the design and fabrication of detention windows of the type required for this project.
- R. Submittal Requirements: All bidders shall obtain approval from the Architect through submission of a full size sample or appropriate manufacturer's "engineering" cut sheet 10 days prior to bid date. The sample must be the same profile, size, finish, and gauge as the detention window type shown on the plans.
- S. Heavy-Duty Woven Wire Steel Partition: Heavy-duty steel detention (horizontal / vertical security mesh) partitions as shown and detailed on the plans and hereinafter specified, shall be produced by manufacturers who have not less than five (5) years' experience and shall now be actively engaged in the design and fabrication of woven wire steel security partitions.
- T. Submittal Requirements: In addition to a written request for equality, a full-size corner sample 18" x 18", full size detail drawings; and catalog information shall be submitted.

1.07 SUBMITTALS:

- A. Shop Drawings: Shop drawings on all equipment of this Section shall be submitted to the Architect. Shop drawings shall be large scale and shall indicate the methods, location, and spacing of anchors, joinery, and construction; finishes, sizes, shapes, alloys, and thickness of materials; and joinery with adjacent work. Shop drawings shall comply with the full intent of design. Any deviation from design intent in shop drawings; not detected in submittal review shall be corrected as required by Architect.
- B. Templates: Immediately after the award of the contract and upon receipt of the approved hardware schedule, the detention contractor shall promptly provide the hardware manufacturer's templates to the metal door manufacturer.
- C. Packing and Marking: Each item of detention hardware shall be packaged and marked according to hardware schedule. Shipping cartons shall be marked "Detention Hardware".
- D. Operating/Maintenance Manuals: Detention equipment contractor shall furnish three (3) copies of parts and maintenance manuals for all detention hardware and all detention locking devices and provide formal instructions for the care of finishes and materials and the operations of all products.
- E. See independent subparagraphs herein for additional requirements and criteria required.
- F. Provide complete wiring diagrams to the Division 17 28 subcontractor for his review and comments. The A/E will not take any action on wiring diagrams, this is for General Contractor coordination.

1.08 PRODUCT HANDLING, STORAGE, AND DELIVERY

- A. Responsibility of the General Contractor: General Contractor shall provide the required opening through the interior and exterior outside walls to permit the placing of the detention equipment in the areas of the building where it is to be installed. Provide free use of hoist

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

and/or cranes on regular time for distribution. General Contractor shall protect all materials during storage on the job and during and after installation. Any protection required to clean adjacent materials shall be the responsibility of the General Contractor.

- B. Provide a secure, dry locked storage area or room in each building and floor for all materials specified in this Division using the following procedures:
 - 1. Store materials in a dry area under cover.
 - 2. Place all material on planking or blocking, at least 4" off ground, 2" off a paved area or floor slab.
 - 3. Provide, by means of wood strips, a space of at least 1/4" between all units for air circulation.
 - 4. Do not stack material flat. Store doors and frames in an upright position with heads uppermost.
 - 5. Place no more than five (5) single opening frames or three (3) multi-opening frames in a group.
 - 6. Do not permit cardboard or paper containers or wrappings to become wet. If this should occur, remove them immediately.
 - 7. Receive, unload, and distribute to installation locations the detention hollow metal doors, and frames, embeds, and other miscellaneous detention items. All embedded items must be installed plumb, true and permanent.
- C. General Contractor shall complete all floor finish, concrete curbs, waterproofing, and other concrete work where shown or specified in connection with the detention equipment and all plastering, patching and finishes on or near detention equipment after detention equipment is installed.
- D. The General Contractor shall insure that any scratches or disfigurement caused by shipping or handling are promptly cleaned (wire brush or sander) and touched up with a rust inhibitive primer or the shipment must be rejected at time of receiving.
- E. The General Contractor shall install all detention hollow metal frames in position true and plumb, aligned and braced securely until permanent anchors are set. Anchor bottom of frames to floor with expansion bolts or power fasteners. Build wall anchors into walls, or secure to adjoining construction as detailed, indicated or specified. Where frames require ceiling struts or other structural overhead bracing, they shall be anchored securely to ceilings or overhead structural framing as indicated or specified. Install all frames as described in the latest edition of the Door and Hardware Institute Manual.
- F. The General Contractor shall submit in writing to the Architect engineering verification that the frames are set plumb and true prior to erection of masonry walls and then again following wall construction. The frames and doors will not be accepted unless the verifications have been properly submitted and approved, before grouting of frames where required.
- G. Remove protective materials, and clean all finished surfaces using clear water and a non-abrasive detergent. Any protection required to clean adjacent materials shall be the responsibility of the General Contractor.

1.09 GUARANTEE:

- A. The Detention Equipment Contractor is to warrant his material and workmanship of this project for a period of one (1) year after date of acceptance by owner. The DEC agrees to repair or replace any defective detention materials and to correct any defective detention work when given written notice during the warranty period.
- B. All security glass shall be warranted against delamination for a period of one (1) year from certificate occupancy.
- C. Glass breakage shall be the responsibility of the General Contractor except for breakage by DEC.

PART 2 - PRODUCTS

2.01 DETENTION HOLLOW METAL DOORS AND FRAMES

- A. The products specified in this section shall be coordinated with Part 3 "DETENTION HARDWARE" and Part 5 "SECURITY GLASS AND GLAZING". All detention doors and frames shall be fabricated by the same manufacturer except for those occurring at cell modules. Note: Labeled openings: All fire rated hollow metal openings as scheduled (door or view panel) shall bear a UL label (entire assembly) unless the applicable opening is protected by a Fire Protection Sprinkler Wash as required by the International Building Code. See Life Safety Drawings. The hollow metal manufacturer shall indicate any specified fire rated openings that cannot be fire labeled and reasons why they cannot. If the designer furnishes the name of an approved manufacturer who can supply the fire labeled openings in question, the manufacturer shall be required to furnish the openings with fire labels at no additional cost. However, if label openings are not available as designed, the designer shall either authorize the necessary changes in opening design, hardware, glass and/or other features which will bring the openings into compliance or drop the fire labeling requirement on openings in question. Manufacturing the openings "Label Construction" without factory applied fire labels shall be unacceptable.
- B. Acceptable manufacturers: Except as otherwise specified herein, or in the General Conditions, the equipment and materials of this Section shall be products of the following manufacturers, subject to compliance with specification requirements and provided each manufacturer meet all requirements of the Quality Assurance Section of this specification.
1. Roots Group, Beirut, Lebanon
 2. Titan Metal Products Inc., Sacramento, CA
 3. American Steel Products, GA
 4. Trussbilt, Huron, SD

2.02 REQUIREMENTS FOR DETENTION HOLLOW METAL FRAMES:

- A. Detention hollow metal materials schedule (see hollow metal schedule)
- B. Frames
1. 12 ga. (grout filled)
 2. All exterior frames and interior as noted on schedule
 3. Galvanize all exterior frames for painting (galvanize for painting at all shower areas and exercise yards.
- C. Doors:
1. 12 ga. All exterior openings. Galvanized for painting.
- D. Materials: Frames for exterior openings shall be constructed of commercial quality, cold rolled steel which complies with ASTM #A366-68. The steel shall be free of scale, pitting, coil breaks or other surface defects. Metal thickness shall be not less than 12 gauge. Frames specified on the drawings as galvanized shall be zinc coated carbon steel sheet in accordance with ASTM A526 and tested by ASTM G60, mill phosphatized. Mullions, jambs, head and sill shall be secured to walls and fully grouted with the exception of lock boxes or other hardware and electronics back boxes.
- E. Construction: All frames shall be custom made welded units of the sizes and types shown on approved shop drawings.
- F. All finished work shall be strong and rigid, neat in appearance, square, and free of defects, warps, or buckles. Pressed steel members shall be straight and of uniform profile throughout their lengths.
- G. Jamb, header, and sill profiles shall be as scheduled by the Architect and shown on the approved shop drawings.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- H. Corner joints shall have all contact edges closed tight with faces mitered and stops either butted or mitered. Corner joints shall be continuously welded. The use of gussets or splice plates will be unacceptable.
- I. Minimum depth of stops in door openings shall be 1", and in glass or panel openings shall be 1". Cut-off stops, where shown, shall be capped at 45° or 90° at heights shown on approved shop drawings, and jamb joints below cut-offs stops shall be welded, filled and ground smooth such that there are no visible seams. Install all stops in accordance with Security Drawings Safe Side Criteria.
- J. Frames having jamb mounted electric locks and door position switches will be provided with factory installed backboxes and conduit between backboxes. Conduit shall be 1/2' minimum EMT or as shown on wiring diagrams and risers and as required by Division 1728.
- K. When shipping limitations so dictate, frames for large openings shall be fabricated in sections designated for splicing in the field by others. Where splicing is necessary, angle reinforcement shall be installed at the corners of the profile, and shall extend at least 4" on either side of the joint. Splicing angles shall be the same gauge thickness as frame. Splices shall be fully field welded, ground smooth, and primed to shop fabrication standards.
- L. Frames for multiple openings shall have mullion members which after fabrication, are closed tubular shapes conforming to profiles shown on contract documents and approved shop drawings, and have no visible seams or joints on faces.
- M. All joints between faces of abutted members shall be welded and finished smooth. All joints between stops of abutted members shall be welded along the depth of the stop and shall be left neat and uniform in appearance.
- N. Hardware Reinforcements and Preparations: Frames shall be mortised, reinforced, drilled and tapped for all template hardware only, in accordance with the final approved hardware schedule and templates provided by the hardware supplier. Where surface mounted hardware is to be applied, frames shall have reinforcements drilled and tapped at the factory for template hardware only, all other drilling and tapping to be drilled and tapped in the field by others.
- O. Minimum thickness of hardware reinforcing plates shall be as follows:
 - 1. Hinge and pivot reinforcements: 1/4" x full width of jamb x 10" in length.
 - 2. Strike reinforcements: 7 gauge.
 - 3. Flush bolt reinforcement: 7 gauge.
 - 4. Closer reinforcement: 7 gauge.
 - 5. Reinforcements for surface applied hardware: 7 gauge.
- P. Floor Anchors: Floor anchors with two holes for fasteners shall be fastened inside jambs with at least four (4) spot welds per anchor.
- Q. Where so scheduled, adjustable floor anchors, providing no less than 2" height adjustment, shall be fastened in place with at least four (4) spot welds per anchor.
- R. Gauge thickness of floor anchors shall be the same as frame.
- S. Jamb Anchors: Frames for installation in masonry walls shall be provided with adjustable jamb anchors of the yoke and strap type made from the same gauge steel as frame. Straps shall be no less than 2" x 10" in size, corrugated and/or perforated. The number of anchors provided on each jamb shall be as follows:
 - 1. Frames up to 7'-6" height: 4.
 - 2. Frames 7'-6" to 8'-0" height: 5.
 - 3. Frames over 8'-0" height: 1 anchor for each 18" or fraction thereof.
- T. Frames for installation in refinished concrete openings shall be punched and countersunk for expansion bolt anchors and provided with hat shaped reinforcements, same gauge thickness as frame, secured in place with at least four (4) spot welds each. The number and spacing of

anchors provided shall be as outlined in section a) above. Fasteners shall be provided by others.

- U. Frames to be installed in refinished concrete or masonry openings, but not to be anchored using expansion bolts, shall be constructed, and provided with anchoring systems of suitable design as shown on the approved shop drawings. Plaster guards made from no less than 26-gauge steel shall be welded in place at all hardware mortises on frames to be set in masonry or concrete openings.
- V. All frames shall be provided with two (2) temporary steel spreaders welded to the feet of the jambs to serve as bracing during shipping, handling, and installation.
- W. Removable Security Glazing Stops: The removable glass stop shall consist of 10-gauge angle securely fastened to the frame using machine screws 1/4-28, 6 inches on center, a minimum of 3 inches from the corners. All exposed screw heads shall be round, pan, or oval type, torx drive, tamperproof and installed with Lock-Tite. The finished glass stop shall be tight fitting and mitered at the corner joints. Mortar guards covering the glass stop screws shall be installed on all masonry grouted frames. There shall be a minimum of 1" glass engagement. All glazing stops shall be installed on the safe side of the wall in which it is positioned. All UL or other labels shall be installed on the safe side of the wall in which it is positioned. NOTE: Glazing stops shall be shipped in-place and temporarily secured with 2 each Phillips head screws.
- X. The frame underneath the glazing stops and inside of the glazing stop shall be chemically treated for maximum paint adhesion and painted with a rust-inhibitive primer prior to installation in the frame.

2.03 REQUIREMENTS FOR DETENTION HOLLOW METAL DOORS:

- A. Materials: Doors shall be constructed using commercial quality, cold rolled steel which complies with ASTM #A366. The steel used shall be free from scale, pitting, coil breaks or other surface imperfections. The steel shall also be free of buckles, waver or any other defects caused by the use of improperly leveled sheets. Face sheets shall be not less than 12 gauge on medium detention rated interior doors unless noted otherwise on door schedule, and 12 Ga. on maximum detention exterior rated doors. All exterior doors shall be galvanized properly treated for finish painting.
- B. Construction: All doors shall be custom made, of the type and sizes shown on the approved shop drawings and shall be prepared for hardware per the final approved hardware schedule. Manufacturer shall coordinate frame dimensions and hardware to thickness of door.
- C. Door edge seams shall be continuously welded and finished smooth.
- D. Nominal door thickness shall be 2" sufficient to accommodate required Detention Hardware and all doors shall be rigid, and neat in appearance, free from warpage or buckle. Edge bends shall be true and straight and of minimum radius for the gauge metal used. Manufacturer shall coordinate frame dimensions and hardware to thickness of doors.
- E. Face sheets shall be stiffened by continuous 1 piece 22 ga. minimum truss shaped core, full height and width spanning the full thickness of the interior space between door faces. These stiffeners shall be 22 gauge minimum, and securely fastened to both face sheets by spot welds spaced a minimum of 3" o.c. vertically and horizontally. Spaces between stiffeners shall be filled with fiberglass or mineral Rockwool batt-type material. All exterior galvanized face plates shall have smooth base galvanized finish acceptable for finish painting.
- F. The vertical edges shall be reinforced by a continuous steel channel, not less than 10 gauge, extending the full length of the door. The top and bottom edges shall be closed with a continuous inverted channel, not less than 12-gauge spot welded to both face sheets a minimum of 3" o.c. Each 12-gauge closing end channel shall be welded to the vertical channel at all four corners producing a fully welded perimeter reinforcing channel.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- G. The top end channel shall be fitted with an additional flush closing channel of not less than 16 gauge. The flush closing channel shall be welded in place at the corners and at the center. Installation of closer channel using screws, security or otherwise, shall be deemed unacceptable. The end channel and flush closer channel shall be installed such that they are permanent and non-removable.
- H. Edge profiles shall be provided on both vertical edges of doors as follows:
 - 1. Single acting doors: beveled 1/8" in 2".
- I. Hardware Reinforcement: Doors shall be mortised, reinforced, drilled, and tapped at the factory for completely templated hardware only, in accordance with the final approved hardware schedule and templates provided by the hardware supplier. Where surface mounted hardware is to be applied, doors shall be reinforced only, and all drilling and tapping shall be done by others in the field.
- J. Minimum gauges for hardware reinforcements shall be as follows:
 - 1. Full mortised hinges and pivots: 7 gauge.
 - 2. Surface applied maximum security hinges: 1/4" plate.
- K. Reinforcements for lock fronts, concealed holders, or surface mounted closers: 12 gauge.
 - 1. Internal reinforcements for all other surface applied hardware: 12 gauge.
- L. Glass Moldings and Stops: Where specified, doors shall be provided with steel moldings to secure glazing by others in accordance with glass sizes and thickness shown on contract documents (glazing schedule) and approved shop drawings.
- M. The removable glazing stop shall consist of 10-gauge angle securely fastened to the frame using Torx button head screws 1/4 - 28 or 1/4 - 20, 6 inches o.c., a minimum of 3" from the corners. Frames and glazing stops shall be match drilled at the factory. The finished glass stop shall be tight fitting and mitered at the corner joints. Mortar guards covering the glass stop screws shall be installed on all masonry grouted frames: There shall be a minimum of 1" glass engagement. NOTE: Glazing stops shall be shipped in-place and temporarily secured with 2 each Phillips heads screws.
- N. It shall be the direct responsibility of the manufacturer of both the detention and non-detention hollow metal doors and/or frames to furnish to the General Contractor or P.S.C. guaranteed daylight opening sizes where glass and/or panels are indicated on the plans with sufficient lead time so as to avoid any delay in construction relating to the ordering of glass/panels.
- O. Fixed glass molding shall be spot welded on the secure side (safe side) a maximum of 5" o.c.
- P. Where glass thickness dictates, 10 gauge, offset surface mounted glass stop shall be used. The corners shall be secured to the face of the door using #8-32 countersunk, Torx head screws spaced 9" o.c. maximum.
- Q. Speaking Devices: A speaking device shall consist of a rectangular pattern of round holes, no more than 1/4" diameter, in both face sheets directly across from each other. The minimum size of the rectangular holes spaced no more than 1" o.c. The interior of the door between the rectangular hole patterns shall be baffled using pressed steel sections, no less than 14 gauge, such that no objects can be passed through.
- R. Food Pass Openings (where applicable): See Detail Door Type 'C' and 'D' (See Schedule). The food pass opening shall be flush opening continuously welded across the bottom and up both sides such that no food or liquid is able to penetrate and also such that it will not be affected by tampering or scraping.
- S. The food pass shutter shall be constructed from two 3/16" steel plates spot welded together to produce an inset fit that, when closed, will prevent tampering with the lock and hinges. See Details.

- T. The shutters shall be chemically treated for maximum paint adhesion and given a shop coat of rust-inhibitive primer. They shall be shipped loose for installation in the field by others.

2.04 FINISH:

- A. Before assembly, all door frames shall be thoroughly cleaned and coated inside and out with a fine grade corrosion resistant iron oxide-zinc chromate primer. After fabrication, all tool marks and surface imperfections shall be dressed clean by grinding, filling, and sanding as necessary to make all faces and vertical edges smooth, level, and free of all irregularities. Doors shall be bonderized and phosphate treated to ensure maximum paint adhesion and coated on all exposed surfaces with a rust inhibitive primer which shall be fully cured before shipment. All surfaces shall be thoroughly cleaned of rust, oil or other impurities and phosphate coated to condition the surface of the metal to resist and inhibit corrosion and promote paint adhesion in accordance with Federal Specification II-C-490. All exterior frames and doors and interior doors at water sensitive locations, including those at showers and toilets and outdoor exercise areas shall receive a full galvanized paint grade prime finish complying with above requirements for quality control.

2.05 INSTALLATION:

- A. Upon direction of the Architect, the General Contractor shall destroy a randomly selected detention hollow metal door or panel by sawing it in half. Should examination disclose door construction at variance with the details specified, the door manufacturer shall, upon direction of the Architect, replace all doors shipped to the project as of the date of inspection with doors conforming to the specifications. Under conditions of non-conformity, the door manufacturer shall pay for the destroyed door and related labor. Should examination prove that the door was constructed in conformance with specifications; the Owner will pay to replace the destroyed door and related labor.
- B. The General Contractor shall submit in writing verification that the frames are set plumb and true prior to erection of masonry walls and then again following wall construction. The frames and doors will not be accepted unless the verifications have been properly submitted and approved. The General Contractor shall install frames in strict accordance with the following tolerances:
1. Plumbness: $\pm 1/16$ "
 2. Squareness: $\pm 1/16$ "
 3. Alignment: $\pm 1/16$ "
 4. Twist: $\pm 1/16$ "
 5. Plumbness, squareness, alignment, and twist methods of measurements are defined in NAAMM, CHM-1-74.
- C. The location of hardware on doors and frames shall be as follows:
1. Hinges: Top - 5" from head of frame to top of hinge.
 2. Bottom hinge - 10" from finished floor to bottom of hinge
 3. Intermediate hinge - centered between top and bottom hinges.
 4. Dutch doors - 5" from head of frame to top of hinge unit and integral type.
 5. Locks and Latches: 38" centerline of knob.
 6. Deadlocks - 60" to centerline of cylinder
 7. Panic Hardware - 38" centerline of cross bar
 8. Door Pulls - 42" to center of grip
 9. Push-pull bars - 42" to centerline of bar from finished floor
 10. Arm Pulls - 48" to centerline of plate
 11. Roller Latches - 45" to centerline
- D. Edge clearance shall be provided as follows:
1. Between doors and frame, at head and jambs 1/8"
 2. At door sills where no threshold is used 3/8" maximum

3. At door sills where threshold is used 3/4" maximum above fin. floor
4. Between meeting edges of pairs of doors 1/8"
- E. Finished floor is defined as the top surface of the floor, except when resilient tile or carpet is used, and then it is the top of the concrete slab. Where the carpet is more than 1/2" thick, allow 1/4" clearance.
- F. It shall be the responsibility of the General Contractor to provide hinge shims and make adjustments as necessary to provide clearances as required. Methods of adjustment shall be as recommended and defined by NAAMM CHM-1-74.
- G. Mullions, jambs, head, and sill of frames shall be secured to walls and fully grouted.
- H. The detention hollow metal manufacturer shall coordinate fully with the detention hardware manufacturer and the DEC to insure proper operation of door frame and lock function.

PART 3 - DETENTION HARDWARE FOR DETENTION DOORS:

3.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division Specification sections, apply to work of this section.

3.02 DESCRIPTION:

- A. The work required herein consists of furnishing and installing detention hardware the installation of detention hardware and related items necessary to complete the work indicated on the drawings and described in this specification.
- B. Where builder type hardware is required in a detention hardware set, it shall be furnished hereunder as listed for the specific case.
- C. The provisions under Division 17 28 shall apply to work specified in this Division.
- D. The provisions under 2.1 "Detention Hollow Metal Doors and Frames", shall apply to work specified.

3.03 MISCELLANEOUS HARDWARE FOR SECURITY DOORS

- A. Acceptable Manufacturers
 1. Except as otherwise specified herein, the equipment and materials of this section shall be products manufactured by one of the listed manufacturers.
- B. Products/Manufacturers:
 1. Hinges: Midwest Portland LLC, Airteq, Southern Steel
 2. Pulls: Northwest Hardware, Airteq, Southern Steel
 3. Door Position Switches: Midwest Portland LLC, Airteq and Sentrol
 4. Door Closures: LCN
 5. Door Stops: Northwest Hardware, Airteq, Glynn Johnson, Ives
 6. Thresholds: Reese, National Guard and Pemko
 7. Weather Strip: Reese, National Guard and Pemko
 8. Smoke Seal: Reese, National Guard and Pemko
 9. Silencers: Glynn Johnson, Ives

3.04 ELECTRO – MECHANICAL, MANUAL DETENTION LOCKS AND SLIDING DEVICES

- A. Acceptable Manufacturers: Except as otherwise specified herein, the equipment and materials of this section shall be products of one of the following Manufacturers:
 1. Airteq (AT), Montgomery, AL
 2. Southern Steel Company (SSCO), San Antonio, TX
 3. Midwest Portland LLC, Minooka, IL

3.05 SPECIAL SUBMITTALS AND CRITERIA:

- A. The DEC shall furnish six (6) copies of the operating and specifications manuals for all detention type hardware. Bind manuals in loose-leaf binders. Each manual shall bear name, address, and telephone number of manufacturer's representative in this area of project.
- B. The DEC shall, upon notice of the Architect and without additional cost to the Owner, provide a factory representative specially trained in operation of security equipment and with a thorough knowledge of its mechanism, for a three (3) workday (24 total hours) instruction and training period. Factory representative must be capable of training custodial personnel and detention staff in operation, repair, and upkeep. The Architect/Engineer shall be notified by registered letter 14 days prior to the (3) workday instruction and training period. Training schedules, rosters, and lesson plans or training manuals will be furnished to the A/E for review and record. All training schedules will be coordinated with Owner's staff to insure availability of personnel. The training program shall be video recorded. Three copies of the recording shall be provided to the Owner. The DEC shall, upon notice of the Architect and without additional cost to Owner, provide a factory representative specially trained in operation of detention equipment and with a thorough knowledge of its mechanism, for a three (3) work day (24 total hours) instruction and training period. Factory representative must be capable of training custodial personnel and detention staff in operation, repair and upkeep. The Architect/Engineer shall be notified by registered letter 14 days prior to the (3) work day instruction and training period. Training schedules, rosters, and lesson plans or training manuals will be furnished to the A/E for review and record. All training schedules will be coordinated with Owner's staff to insure availability of personnel. The training program shall be recorded. Three (3) copies of the recording shall be provided to the Owner.
- C. Shop drawings shall be submitted in a yellow hard back three ringed binder. It shall have a label on the front cover with job name, date, General Contractor's name and specification number/title. It shall contain the entire shop drawings with no sheets longer than 11" x 17". If large sheets are submitted, they shall be punched and folded to fit into the binder. Shop drawing submittal shall contain catalogue cut sheets, templates and specification on hardware sets, closers, pushbuttons, door position switches, hinges, strikes, pulls, thresholds, weatherstripping, silencers, door bumpers, electric bolt keepers, security screws, and wiring diagrams. When these items are submitted in the three (3) ring binder, they shall be separated by a tabbed reinforced index sheet indicating what is behind each section. Door references shall be the same as used in the contract documents. When assembling drawings, if there are questions, item in question should be highlighted in yellow. Wiring diagrams are not valid until the A/E has reviewed them. The wiring diagrams are not for the A/E; they are for the Division 17 28 subcontractor.
- D. The DEC shall furnish one (1) of each type of electric lock, to Division 1728. Thirty (30) days after the Division 17 28 (SEC) Contractor has received the locks there shall be a The DEC shall furnish one (1) of each type of electric lock, to the Division 17. Thirty (30) days after the Division 17 (SEC) Contractor has received the locks, tformal meeting which shall include the DEC, the Division 17 28 (SEC) Contractor, the Division 4 masonry Contractor (and/or the modular cell manufacturer), the Security System Design Engineer, the Architect and the Owner's Representative to discuss the upcoming work and the coordination of that work and shop drawings.
 1. The following items shall be discussed.
 - a. Mounting of locks and frames, which shall include masonry items.
 - b. Routing of conduit
 - c. Preparation of doors and frames (opening for locks and DPS, etc.)
 - d. Hardware functionality
 - e. Wiring Diagrams
 - f. Frames and Glazing

3.06 PRODUCTS - GENERAL:

- A. Immediately after the award of the general contract, the General Contractor shall obtain a production and delivery schedule from the DEC, SEC and associated manufacturers. The schedule shall be submitted to the Architect for approval. Upon receipt of the approved hardware schedule, the DEC shall promptly place order for the detention hardware. The DEC shall secure from the hardware manufacturer the necessary template for use by the hollow metal manufacture and shall promptly furnish these templates to the manufacturers to eliminate possibility of delay.
- B. Each item of detention hardware shall be packed and marked in accordance with the set numbers on approved hardware schedule. Shipping cartons shall be marked "detention hardware" for identification on the job.
- C. The hardware operating characteristics shall be configured to be fully compatible with operational requirements contained in the locking control system specifications in the SEC Locking Control section of Division 17000.28. The hardware operating characteristics shall be configured to be fully compatible with operational requirements contained in the locking control system specifications in the Division 17000 specifications.
- D. KEYING:
- E. Individual keying of all cylinders shall be only as directed by the Architect and Owner. It is required that a meeting be arranged with the Architect and Owner to lay out the required keying schedule which shall be submitted for final review and approval by the Architect and Owner after this meeting.
- F. The DEC shall be responsible for the day keys and the same shall be delivered to the Owner in the manner he directs. The Owner will provide a receipt for all keys received.
- G. All master keys shall be sent directly to the Owner prepaid via registered mail.
- H. Furnish a complete key control cabinet for each control room (3) inside Central Control Room to accommodate all detention hardware keys and all builder's hardware keys for the project. One master cabinet shall be provided for the main control center. The system shall be furnished with a capacity of 1.75 times the number of door locks. Each cabinet shall have high security manipulation resistant combination lock. System shall include completely set up three (3) way, cross index system, installation of keys and dual tag system, and instructions to the Owner on proper use of the system. Acceptable manufacturers: Talkee, Inc., or or Key Control Systems, Inc..
- I. All keys shall be factory cut and shall bear a die-stamped factory key code. Keys must always remain under a responsible accountability. Any indication that keys are lost or possibility of duplication will be cause for complete rekeying at the DEC's expense.
- J. Mogul pin-tumbler cylinders and ASSA cylinders shall be keyed alike in groups and master keyed as directed; supply 5 keys of each change and 3 master keys.
- K. Paracentric prison locks shall be keyed alike in sets as directed; supply 3 keys of each change.

3.07 MISCELLANEOUS HARDWARE FOR SECURITY DOORS

- A. Acceptable Manufacturers
 - 1. Except as otherwise specified herein, the equipment and materials of this section shall be products manufactured by one of the listed manufacturers.
- B. Products/Manufacturers
 - 1. Hinges: Midwest, Airteq or North West Specialty (NWS)
 - 2. Pulls: Northwest Hardware, Airteq or North West Specialty (NWS)
 - 3. Door Position Switches: Midwest Portland, Airteq or Sentrol
 - 4. Door Closures: LCN, Rikson or Sargent
 - 5. Door Stops: Midwest, Airteq or North West Specialty (NWS)

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

6. Thresholds: Reese, National Guard or Pemko
 7. Weatherstrip: Reese, National Guard or Pemko
 8. Smoke Seal: Reese, National Guard or Pemko
 9. Silencers: Glynn Johnson, Quality or Ives
 10. 10.Torx security screws (flat head, button head, oval head, counter sunk, etc.) shall be used on all exposed locations
- C. Product Description
1. Hinges
 - a. Full Mortise Detention Hinges (Airteq #604FMCS (or Eq.) shall be 4-1/2" x 4-1/2" x 0.188" thick investment cast 304 stainless steel with hospital tips and integral studs on both leaves. Pins shall be hardened stainless or alloy steel, concealed and non-removable. Each hinge shall be supplied with eight (8) 1/4 - 20 flat head machine screws. Hinges for fire labeled doors shall be US32D finished.
 - b. Surface Mounted Access Door and Food Pass Hinges shall be 3" x 4" x 0.210" min., fabricated from bonderized steel and prime painted. Hinge barrels shall be solid with no visible pin line. Pin shall be fully welded. Each hinge provided with our 3/8-16 button head Torx machine screws.
 - c. Surface Mounted Food Pass Hinges shall be 3" x 4" x 0.210" min., fabricated from bonderized steel and prime painted. Hinge barrels shall be solid with no visible pin line. Pin shall be fully welded. Hinges shall be provided with a stop capable of restricting the hinge from rotating more than 90 degrees, allowing the food pass door to act as a shelf. Each hinge provided with four 3/8-16 button head Torx machine screws.
 2. Pulls
 - a. Grip Type Door Pulls shall be cast of brass or bronze with satin finish of approximately US4 unless specified otherwise in hardware schedule. Overall length, 8-3/4"; handhold, 5-1/4"; grip clearance, 1-1/2"; attachment holes, 7-3/4" O.C. Provide two (2) 3/8-16 x 5/8" oval head screws. Provide clear lacquer finished baked for 15 minutes at 350 degrees and allow cooling before packaging.
 - b. Flush Type Door Pulls (inmate side) shall be fabricated as an integral part of the hollow metal door.
 3. Door Position Switches
 - a. Recessed Magnetic Door Position Switches (Airteq #6200 Series or Eq.) shall be a five (5) reed switch magnet mortised type assembly used for remotely monitoring the door status/position. The device shall be moisture resistant and fit within 2" hollow metal door jamb. The device shall be field adjustable on 2 axis and supplied with a 3' vinyl jacketed lead wire and a 3 pin Molex connector. The device shall be all steel construction. The switch and magnet shall be encased in epoxy resin. The overall DPS dimension shall be approx. 1-1/4" x 4-7/8" x 1".
 4. Door Closers
 - a. High Security Closer with Door Position Switches shall be controlled by overhead concealed closers which have been tested to ten million (10,000,000) opening-closing cycles. Closers shall have full hydraulic rack and pinion action with high strength cast iron cylinders. Spring power shall be adjustable. Hydraulic fluid shall be of a type requiring no seasonal adjustment for temperatures ranging from 120 degrees F to -30 degrees F. Separate tamper-proof screw valves shall provide independent regularization of latch speed, general speed, and hydraulic back check. Regulating screws shall be accessible through a heavy-duty mounting plate when finish plates are removed. Closers shall have an integral electro-mechanical device rated not less than 24 VAC @ 10 amperes to detect and signal rotation of the closer pinion. This device shall be field adjustable to allow setting for each door and fitting with a protective shield. Installation of the finish plate shall fully conceal all adjustment

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
 MENTAL HEALTH / MEDICAL UNIT
 ANNISTON, ALABAMA

mechanisms. Closer shall have an extra heavy duty forged steel concealed arm. The low friction track roller shall be attached to the arm DPS by a threaded mounting. Closers shall have a metal track designed to prevent jamming and to eject foreign objects placed in the track mortised into the top of the door. The exposed fasteners shall be Torx screws with a security pin.

5. Door Stops
 - a. Wall or floor mounted doorstops shall be a tamper resistant device that is embedded into the wall or floor with an epoxy resin adhesive. Bumper shall be 2" diameter x 3-1/2" long and made from a non-hazardous silicone elastomer, 80 durometers. The threaded and grooved steel mounting shank shall be 5/8" in diameter and embedded into the bumper at least half the length of the bumper. Mounting shank shall extend 2-1/2" beyond the bumper bottom for embedding into the wall or floor.
6. Thresholds
 - a. Thresholds shall be supplied at all exterior smoke and fire labeled door openings and installed with flat head screws.
 - b. Pass-Resistant Thresholds.
7. Weather Strip (Pemko #S88 or Eq.) shall be a self-adhesive and pressure sensitive door gasketing material that may be compressed sufficiently to seal 1/16" toleranced door and will not lose its form. The product shall be non-toxic, self-extinguishing, and impervious to fungus and mildew. Once installed razor cut to approximately 12" increments.
8. Door Silencers (Glynn Johnson #64 or eq.) shall be standard resilient type and removable for replacement.

3.08 DETENTION HARDWARE SCHEDULE:

HARDWARE SET SHO1

HNG1	HINGES	3	
LCK2221	LOCKSET	1	
CDP5	CLOSER/DPS	1	
GPL2	GRIP PULL	2	
TLD309	THRESHOLD	1	
WST417	WEATHERSTRIP	1	
WST416	WEATHERSTRIP	2	
SIL1	SILENCERS	3	
FS 1	FLOOR STOP	1	

HARDWARE SET SHO2

HNG1	HINGES	3	
LCK2221	LOCKSET	1	
CDP5	CLOSER/DPS	1	EXTERIOR GRADE
GPL2	GRIP PULL	2	
SIL1	SILENCERS	3	
FS 1	FLOOR STOP	1	

HARDWARE SET SHO3 (EXTERIOR ENTRY SLIDER)

HNG1	HINGES	4	
LCK2221	LOCKSET	1	
CDP5	CLOSER/DPS	1	EXTERIOR GRADE
GPL2	GRIP PULL	2	
SIL1	SILENCERS	3	
FS 1	FLOOR STOP	1	

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
 MENTAL HEALTH / MEDICAL UNIT
 ANNISTON, ALABAMA

HARDWARE SET SHO4

HNG1	HINGES	3	
LCK2051	LOCKSET	1	KEY 1 SIDE ONLY
FHG3	FOOD PASS HINGE	2	
FLK1	FOOD PASS LOCK	1	
CDP3	CLOSER/DPS	1	
GPL2	GRIP PULL	1	
FPL6	FLUSH PULL	1	
PBN11	PUSH BUTTON	1	
SIL1	SILENCERS	3	
SD1	SPEAK DEVICE	1	WHERE SHOWN ON DOOR TYPE
FS1	FLOOR STOP	1	

* ADD SMOKE SEALS @ SMOKE RATED DOORS & WALLS.

HARDWARE SET SHO5 * FOR SMOKE OR FIRE RATED OPENINGS

HNG1	HINGES	3	
LCK2211	LOCKSET	1	
CDP3	CLOSER/DPS	1	
GPL2	GRIP PULL	2	
SIL1	SILENCERS	3	
FS1	FLOOR STOP	1	

* ADD SMOKE SEALS @ SMOKE RATED DOORS & WALLS. TYPICAL.

HARDWARE SET SHO6*

HNG1	HINGES	3	
LCK2051	LOCKSET	1	KEY 1 SIDE ONLY
CDP3	CLOSER/DPS	1	
GPL2	GRIP PULL	1	
FPL6	FLUSH PULL	1	
SIL1	SILENCERS	3	
FS 1	FLOOR STOP	1	

HARDWARE SET SHO7

GATE HARDWARE

HNG1	HINGES	3	
LCK2051	LOCKSET EXTERIOR FENCE MOUNTING	1	
CDP3	CLOSER/DPS EXTERIOR W/ FENCING	1	
GPL2	GRIP PULL	2	

*NOTE: SEE CHAIN LINK GATE DETAILS

HARDWARE SET SHO8

HNG1	HINGES	3	
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CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
 MENTAL HEALTH / MEDICAL UNIT
 ANNISTON, ALABAMA

LCK2051	LOCKSET	1	KEY 1 SIDE ONLY
FHG3	FOOD PASS HINGE		
FLK1	FOOD PASS LOCK	1	
CDP3	CLOSER/DPS	1	
GPL2	GRIP PULL	1	
FPL6	FLUSH PULL	1	
PBN11	PUSH BUTTON	1	
SIL1	SILENCERS	3	
SD1	SPEAK DEVICE	1	
FS1	FLOOR STOP	1	

HARDWARE SET SH 09 (STORAGE 207 ACCESS DOOR)

HNG1	HINGES	3	
LCK87	LOCK	1	
CDP3	CLOSER/DPS	1	
GPL2	GRIP PULL	1 (IN STORAGE)	
FPL6	FLUSH PULL	2 (IN DAYSPACE)	
SIL1	SILENCERS	3	
FS1	FLOOR STOP	1	
SBD	SECURITY BAR DEVICE	1	

HARDWARE SET SH 09A

PAIR OF DOOR LEAVES WITH WEATHERSTRIPPING

HARDWARE SET SH10

SDLD-2B	SLIDING DEVICE	1 W/ EMERGENCY RELEASE
FBL6	FLUSH PULL	2

*ADD SMOKE SEALS AT SMOKE RATED DOORS AND WALLS

HARDWARE SET SH11 (CELL CHASE DOOR)

HNG1	HINGES	3
LCKFA 12	LOCK	1
FPL6	FLUSH PULL	2
SIL1	SILENCERS	3

*ADD SMOKE SEALS AND SMOKE AND FIRE RATED DOORS

HARDWARE SET SH12 (MANUAL LOCKING)

HNG1	HINGES	4
LCK2221	LOCKSET	1
CDP5	CLOSER/DPS	1 EXTERIOR GRADE
GPL2	GRIP PULL	2
SIL1	SILENCERS	3
FS 1	FLOOR STOP	1

3.09 SPECIFIC PRODUCT DESCRIPTIONS:

- A. CDP - Closer / DPS
- B. CDP — Closer/DPS
- C. CDP5 LCN #2215 with DPS x AL x Torx Security Screws or equal
- D. CLO — Closer
- E. CLO127 LCN #2214 x AL x Torx Security Screws less Door Position Switch or equal
- F. Door Position Switch - DPS2207 Sentrol #2207-A Overhead Door Magnetic Contact, or equal
- G. FHG - Food Pass Hinge - FHG Folger Adam #3FP x USP x Flat Head Security Screws 3" x 4" surface mounted hinges, screw applied with Torx flat head screws, counter sunk.
- H. FLK - Food Pass Lock (deadbolt) - FLK1
- I. FPL - Flush Pull - FPL6 — Fabricated Integral to hollow metal door (Inmate side of the door)
- J. GPL - Grip Pull - GPL2 Folger Adam #2 x US26D x Security Torx Screws
- K. 11. HNG – Hinges
- L. HNG1 – 4.5 x 4.5 full mortise hinges
- M. 12. KPS - Keeper Switch: KPS126 To be supplied by the approved lock manufacturer.
- N. 13. LCK — Lockset:
- O. LCK10 — Mechanical Deadbolt for food pass and pipe chase doors. Deadlocks and unlocks by paracentric key.
- P. LCK68 - Folger Adam #66KL x USP x US26D knobs (less cylinder) Mechanical Mortise latchbolt lockset (less cylinder). Latches automatically when door is closed, knobs operate latchbolt.
- Q. LCK87 - Folger Adam #86 x Galv (keyed two sides) Mechanical Deadbolt Lock - Deadlocks and unlocks by paracentric key.
- R. LCK1202 Folger Adam #125-1-01 x US26D (keyed One Side) x MO x Torx Security Screws
 - 1. Mechanical Mortise Latchbolts: A medium security mortise lockset for 1-3/4" and 2" thick individual swing doors that comply with the standard test methods defined in ASTM F1577-95b, security grade 2. Locksets shall be supplied with high security rose and functions as specified by the door and/or hardware schedule. Lockset shall be UL listed for use with fire-rated doors where specified. Lockset shall fit standard ANSI (A115.1) door edge and frame preparation. Latch bolt shall be one-piece stainless steel anti-friction type with 3/4" throw, meeting ANSI A156.13. Deadbolt shall be investment cast stainless steel with hardened steel insert and a 1" throw. Dead lock actuator shall be stainless steel. Strike shall be ANSI standard, universal brass or stainless steel. Faceplate shall be US32D finish unless otherwise specified. Lever handles shall be solid stainless steel (US32D finish). Lockset to be keyed 1 side with mogul cylinder.
- S. LCK1202 -Deadlocking latchbolt. Outside knob lever is rigid at all times. Latchbolt operated by mogul key cylinder on outside, or by knob on inside.
- T. LCK1206 - Folger Adam #125-1-08 x US26D (keyed both sides) x MO x Torx Security Screws Mechanical Mortise latchbolt lockset. Deadlocking Latchbolt. Both knob levers are to be rigid at all times. Latchbolt operated by mogul key cylinder on both sides.
- U. LCK2051 -Folger Adam #122E-1-01 x MO-US26D x USP x 120VAC x Keyed Cover Side x Torx Security Screws A 120VAC maximum security remote controlled, solenoid operated lock for individual swing doors that complies with the standard test methods defined in ASTM F1577-95b, Security Grade [1, 2]. A 7" frame mounted slam-lock with automatic deadlocking. Keyed 1 side with mogul key.
 - 1. Unlocks when the solenoid is energized by momentary contact switch. Once unlocked, the latchbolt is held mechanically retracted until the door is opened. Once the door is opened,

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

the latch bolt extends automatically. Mechanical unlocking is by a mogul cylinder cover side only. Lock shall have a mechanical roller-bolt deadlock actuator and shall automatically deadlock when door is closed.

- V. LCK2211 Folger Adam #126E-1-04 x MO-US26D x USP x 120VAC x Keyed Both Sides x Torx Security Screws. A 120VAC maximum security remote controlled, solenoid operated lock for individual swing doors that complies with the standard test methods defined in ASTM F1577-95b, Security Grade [1, 2]. A 7" frame mounted slam-lock with automatic deadlocking. Keyed 2 sides with mogul key.
- a. Unlocked when the solenoid is energized by momentary contact switch. Once unlocked, the latchbolt is held retracted as long as solenoid is energized. A maintained contact switch may be used at the control panel to keep the latchbolt retracted for an extended period of time. Mechanical unlocking is by a mogul cylinder. Lock shall have a mechanical roller-bolt deadlock actuator and shall automatically deadlock when door is closed.
- W. LCK2221 - Folger Adam #126EDR-1-04 x MO-US26D x Galv x 120 VAC x Keyed Both Sides x Torx Security Screws. A 120VAC maximum security remote controlled deadbolt lock, solenoid operated lock for individual swing doors that complies with the standard test methods defined in ASTM F1577-95b, Security Grade 1. A 7" frame mounted deadbolt. Keyed 2 sides with mogul key.
1. Unlocks when the solenoid is energized by momentary contact switch. Once unlocked, the deadbolt is held electrically retracted while the door is opened. The deadbolt extends automatically when the door is closed, or if the solenoid is de-energized while the door is still closed. Mechanical unlocking is by a Mogul key either side.
- X. LCK2471 - Folger Adam #126ED-4-01 x MO-US26D x Gal x 120VAC x Keyed Both Sides x Torx Security Screws. A 120VAC maximum security remote controlled deadbolt lock, solenoid operated lock for individual swing doors that complies with the standard test methods defined in ASTM F1577-95b, Security Grade 1. A 7" frame mounted deadbolt. Keyed 2 sides with mogul key.
1. Unlocks when the solenoid is energized by momentary contact switch (at the control panel), or emergency unlock signal (fire alarm). Once unlocked, the deadbolt is held mechanically retracted — regardless of door position — and must be relocked with a key. Mechanical unlocking is by a Mogul Cylinder either side. Once unlocked by key, the deadbolt remains retracted until relocked by key.
- Y. LCK3212 - R.R. Brink #3022 x Keyed One Side x US26D x 34VDC x FSE x FKC x JCLH (Momentary Contact Latch Holdback) x Torx Security Screws x Plug connector. A 24 VDC medium security remote controlled, solenoid operated lock for individual swing doors that complies with the standard test methods defined in ASTM F1577-95B, Security Grade 2. A 2" frame mounted mortised slam-lock with automatic deadlocking. Lock can be keyed 1 or 2 sides with mortise cylinder.
1. With momentary activation from the control station, depression of the lock control button, the latchbolt is retracted and will remain retracted when the momentary contact is activated. until the door is opened, at which time the lock latchbolt will extend allowing the door to be slammed locked. will reset. The door must be opened for the lock latchbolt to extend. to be reset. When the latch is retracted by key, the latch will remain retracted as long as it is held retracted by the key. In the event of a power failure the latchbolt goes to, and or remains in, the locked position.
- Z. LCK3216 - R.R. Brink #3026 x Keyed Two Sides x US26D x 24VDC x FSE x FKC x KCE x MCLH (Momentary Contact Latch Holdback) x Torx Security Screws x Plug Connector. A 24 VDC medium security remote controlled, solenoid operated lock for individual swing doors that complies with the standard test methods defined in ASTM F1577-95B, Security Grade 2. A 2"

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

frame mounted mortised slam-lock with automatic deadlocking. Lock can be keyed 1 or 2 sides with mortise cylinder.

1. With momentary activation from the control station, depression of the lock control button the latchbolt is retracted and will remain retracted until the door is opened, at which time the lock latchbolt will extend allowing the door to be slammed locked. reset. The lock shall have momentary contact latch holdback function. The door must be opened for the latchbolt to re-extend. lock to be reset. When the latch is retracted by key, the latch will remain retracted as long as it is held retracted by the key. In the event of a power failure the latch bolt goes to, and or remains in, the locked position. Latches automatically when door is closed. Knobs operate latch bolt.

AA. MTG — Lock Mounting — To be supplied by the approved lock manufacturer.

BB. MTG1 Folger Adam HM x USP x Security Torx Screws (less escutcheon)

1. MTG2 Folger Adam HM x GALV x Security Torx Screws

2. PBN - Push Button - Frame preparation only for pushbutton to be furnished and installed

CC. SIL — Silencers shall be standard resilient type and removable for replacement = SIL1 Quality #1337A

DD. TLD — Threshold shall be supplied at all exterior smoke and fire labeled door openings and installed with flat head screws - TLD305 National Guard #884V x AL x Standard Screws

EE. TLD309 National Guard #884V x AL x Standard Screws x 4'-0"WST.

FF. Weatherstrip; WST416 National Guard #106NA x Std. Screws x 6"-8";

GG. WST417 National Guard #106NA x Std. Screws x 4"-0";

HH. WST418 National Guard #106NA x Std. Screws x 3"-0"

3.10 EXECUTION

- A. Installation: The electrical circuits for each and every locking system shall be tested by the representative of the DEC and electrical contractor and shall be certified as having compatible voltage, protection against overload and duty cycle capability consistent with the operation and installation.
- B. The DEC and SEC PSC/detention hardware manufacturer shall review the control consoles shop drawings and theory of operation, other devices, and systems as being compatible with all detention hardware. at the Prework Conference Submittal Review at the A/E office.
- C. A complete system wiring diagram for all locks and controls shall be prepared by the hardware manufacturer for coordination with the security control of the control consoles. Thesesystem. These wiring diagrams shall be reviewed and approved by the DEC and SEC for correctness with respect to lock functions, monitoring requirements, number of conductors and connection points. No deviations, modifications or changes from the information contained in the contract documents, approved shop drawings and wiring diagrams shall be allowed. In the event that hardware manufacturing changes which occur after approval of shop drawings or wiring diagram require any additional costs to the Project, such additional costs shall be borne by the detention hardware manufacturer.
- D. The DEC and detention hardware manufacturers shall review and approve all hollow metal door and frame shop drawings for proper acceptance of the detention hardware. If any modification must be made to the doors and frame during construction for proper hardware fitoperation, there shall be no additional cost to Owner.

PART 4 - SECURITY / DETENTION ACCESSORIES & FURNISHINGS (SEE FIXTURE SCHEDULE INCLUDED HEREIN)

4.01 GENERAL: ITEMS SHOWN ON THIS SCHEDULE WILL BE FURNISHED UNDER THIS CONTRACT BY THE APPLICABLE CONTRACTOR, SUBCONTRACTOR OR VENDOR.

4.02 SCHEDULE: SEE AS FOLLOWS: SEE DRAWINGS FOR FIXTURE SCHEDULE / MATRIX

4.03 DESCRIPTION OF WORK:

- A. Work included: The DEC, General Contractor and PCMC shall provide Detention Equipment furnishings, furnishings and accessories and/or the associated anchorage for each item, etc. as described below required for this work as indicated on the drawings and specified herein. The work includes but is not necessarily limited to items outlined on the fixture schedule / matrix in the drawings.
- B. Note: Furnishings and accessories listed above and shown on drawings will be furnished and installed in the Base Bid by the DEC, the PCMC, or the General Contractor, as scheduled. All weld plates, embeds, angles, anchors, etc. for these items shall be furnished and installed as detailed on drawings and as required for complete installation by the scheduled party under Division 5, 11 or 13 of this contracts. Any recessed items shall be furnished and installed under this contract by the General Contractor, DEC and/or PCMC complete with weld plates, embeds, etc. This General Contractor Division 11 and Division 13 subcontractor (PCMC) shall afford full cooperation and coordination to all parties to insure a complete installation. See Detention Furnishings and Fixture Schedule on Drawings.

4.04 SUBMITTALS

- A. Each Contractor shall submit shop drawings on each item listed above in a bound folder. These may be manufacturer's catalogue cuts; however, they shall include mounting details and hardware. Any templates required for fabrication of opening required to install equipment shall be included in the shop drawing submittal. When this booklet is submitted, it shall have a title cover listing job name, specification section name and number, Contractor's name, and date. Submit six copies for approval.

4.05 QUALITY ASSURANCE:

- A. Detention accessories manufacturer shall have had a minimum of five (5) years' experience in this type of work.

4.06 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Wrap, label, crate and protect finished items against damage in transit or on job.

4.07 ACCEPTABLE MANUFACTURERS:

- A. Except as otherwise specified herein, or in the specific conditions of the General Contractor, the equipment and materials of this section shall be products of the following manufacturers, subject to compliance with specification requirements and provided each manufacturer meets all requirements of the Quality Assurance Section of the specifications.
- B. Acceptable Manufacturers:
 - 1. Roots Group, Beirut, Lebanon
 - 2. Southern Steel, San Antonio, TX
 - 3. Industrial and Detention Fabricators, Inc. (IDF) Theodore, AL
 - 4. Cornerstone Detention

4.08 DETENTION BEDS

- A. Pan Type Floor Mounted Steel Bunks Double: (Item 28, 29) (Existing to be reused from Owner's Attic Stock. Overall size of bunk to be 6'-8-3/8" long x 2'-3-3/8" wide x 4'-4" high with storage locker drawer where shown on drawings. Provide 2" x 2" x 3/16" steel angle legs at all

four (4) corners. Legs to have integral mounting plate with 7/16" diameter hole for bolting to floor. Bottom of bunk pan to be 12-gauge steel and framed on all four (4) sides with 2" x 2" x 3/16" steel angles. Provide bunk bottom with eight (8) each one-inch (1") diameter holes. Mount bunk framing angles with top edges at 16" and 52" above the finished floor. Entire assembly to be joined by electric arc welding at such points and intervals as will develop adequate strength of all members. All welds to be of neat appearance. All required anchors to be provided by the installer.

- B. Pan type Wall Mounted Steel Bunks: (Item 7) Universal formed steel pan. Bunks shall have a baked-on-factory-applied polyester powder coat finish. Pan: 12 gauge steel. Standard size is 27" x 80" Wall Mounted Bracket: 7 gauge steel. Installation Weld unit to wall plates.

4.09 PAN TYPE WALL MOUNTED DETENTION DESK (ITEM 5)

- A. See Details. Provide all embeds, plates, angles, etc. this contract. Complete desks with finish shall be purchased direct from the manufacturer and installed by Division 13.

4.10 MIRROR (FURNISH UNDER THIS CONTRACT / DIVISION 11 DEC)

- A. (Item 3): Provide mirror made with frame outside measurements approximately 12 1/2" x 16 1/2" and having min mirror opening 9-1/2" x 12-1/2". Frame to be 1-1/4" wide, fabricated from 16 gauge cold rolled carbon steel with 1/4" inner flange. Frame to be chrome plated. Mirror to be made of 180gauge stainless steel Type 304 with #8 finish. Include six (6) each 1/4 - 20 x 1/2" chrome plated type oval head Torx machine screws. Provide 1/4" steel anchor plate 1-1/2" x 14-1/2" with four (4) each 3/8" x 4" long studs. Anchor plate to be pre-drilled and tapped to receive mirror fasteners. Provide embed plate and coordinate locations with masonry subcontractor, this contract. Perimeter shall be caulked with security caulk.
- B. (Item 4): Provide mirror made with frame outside measurements approximately 12-1/2" x 31". Frame to be 1-1/4" wide, fabricated from 16 gauge cold rolled carbon steel with 1/4" inner flange and 9/16" outer flange. Frame to be chrome plated. Mirror to be made of 18-gauge stainless steel Type 304 with #8 finish. Include six (6) each 1/4 - 20 x 1/2" chrom plated type oval head Torx machine screws. Provide 1/4" steel anchor plate 1-1/2" x 14-1/2" with four (4) each 3/8" x 4" long studs. Anchor plate to be pre-drilled and tapped to receive mirror fasteners. Provide embed plate and coordinate locations with masonry subcontractor, this contract. Perimeter shall be caulked with security caulk.

4.11 WALL MOUNTED DETENTION STOOL (ITEM 6)

- A. Provide stool with overall height of 20". Leg to be made 2" ASTM A120 Schedule 40 steel pipe. Leg shall be welded to 6" x 6" x 1/4" floor mounting carbon steel plate. Floor mounting plate shall have four (4) each 7/16" diameter holes at 4" O.C. Seat to be 16 gauge stainless steel, type 304 with No. 2 finish. Seat to be 12" diameter formed over a 1/4" x 11-3/4" diameter carbon steel plate and welded in place. Seat unit shall be welded to steel pipe. Entire unit to be joined by electric arc welding at such points and intervals as will develop adequate strength of all members. All required anchor bolts (dive pins) to be provided by installer. Perimeter of floor mounting plate shall be caulked with security caulk.

4.12 SECURITY SHELF (ITEM 1)

- A. Provide unit of one-piece construction with overall size of 18" wide x 8" deep x 5" high back plate. Front edge to be hemmed 1". Sides to be turned up to form gussets and welded to back plate. Back plate to have four (4) each 7/16" holes for attaching to wall. Anchors bolts to be provided by installer. Underside of shelf to have four (4) each safety hooks on 5" centers. Unit to be fabricated of 11-gauge carbon steel. Entire assembly to be joined by electric arc welding at such points and intervals as will develop adequate strength of all members. All welds to be of neat appearance. Perimeter shall be caulked with security caulk.

4.13 DAYROOM TABLE / DINING TABLE (ITEM 26)

- A. Overall size of unit to be approximately 40" x 40" x 2'-6" above finish floor. Top to be 10-gauge steel and 3'-6" wide across with 1-1/2" flange. Top to be mounted to 1/4" steel top support approximately 2'-6" square. Pedestal to be 4" square steel tube. Mount pedestal to 16" x 16" x 1/4" steel base plate. Base plate to have four (4) each 7/16" diameter holes. Seats (4) to be 16-gauge stainless steel, type 304 with No. 2 finish. 12" in diameter. Form seat over 1/4" base plate with inward fold. Mount base plate to 3" square steel tubing support arm. Weld support arm to pedestal. Entire assembly to be joined by electric arc welding at such points and intervals as will develop adequate strength of all members. All welds to be of neat appearance. All required anchors to be provided by the installer. Unit to be shipped knocked down with all bolted connections to be field welded.

4.14 PISTOL LOCKER (FURNISH UNDER THIS CONTRACT) (ITEM 35) TWO REQUIRED. ONE AT VEHICULAR SALLYPORT, ONE AT MAIN LOBBY

- A. Provide unit with overall size of 40" wide x 27" high x 5-1/4" deep and having six (6) individual compartments approximately 15" wide x 6" high x 4-1/4" deep. Faceplate of the unit and compartment doors to be 3/16" steel plate, individual compartments and recessed compartment housing to be 11 gauge sheet steel. Each compartment to be felt lined, pivot on a continuous steel hinge and individually locked with a concealed security snap lock. Each lock will be individually keyed and master keyed. Unit be flanged 1-1/2" on all four (4) sides and provided with eight (8) 7/16" diameter holes for mounting to wall. Entire assembly to be joined by electric welding at such points and intervals as will develop adequate strength of all members. All welds will be of deep penetration and neat appearance. Exterior of units shall paint finished in custom color selected by Architect. Coordinate for surface mounted installation on concrete module with PCMC. DEC contractor will submit affidavit that all sidearm weapon types currently in use by local law enforcement officials has been coordinated with respect to locker compartment size.

4.15 DETENTION ACCESS PANEL & DOORS (ITEM 8: FURNISH UNDER THIS CONTRACT DIVISION 11 DEC IN MASONRY AND IN PCMC CONTRACT IN CONCRETE MODULE OPENING)

- A. See details: Provide access panels as detailed in the drawings. Panel to have 3/16" plate door in size as detailed. Hardware shall be surface mounted institutional hinges approximately 3" x 4" x 0.210" min. for wall-mounted access panels as detailed on drawings. Each hinge provided with four 3/8-16 button head Torx machine screws. Use mechanical deadlock (from approved lock manufacturer) with both types of panels.

4.16 WALL MOUNTED BENCHES (ITEMS 21, 22, 23)

- A. All benches are wall mounted steel furnished under this contract and as detailed on drawings.

4.17 PACKAGE / SECURITY PASS BOX (ITEM 37: FURNISH IN DEC CONTRACT)

- A. See Details: Package, receivers / pass box as detailed on the drawings.

4.18 TELEVISION WALL ARM (FURNISH IN DIVISION 11 DEC CONTRACT. SEE DIVISION 26 AND 28 FOR ALL T.V. LOCATIONS)

- A. Television wall brackets shall be constructed of 1- gauge steel in three parts: mounting plate, stand and stand support. Stands shall be 6-1/4" wide. Television arms shall feature all welded construction with edges and welds ground smooth.

4.19 RECESSED SECURITY TISSUE HOLDER (ITEM 33: FURNISH IN DEC CONTRACT)

- A. Equal to Acorn No. 1840. Furnish at all non ADA Fixtures.

4.20 SECURITY (SAFETY) GARMENT HOOKS (ITEM 2 – FURNISH IN DEC CONTRACT)

- A. See Details. Garmet hooks device shall be equal to Folger Adams 4 Hook Suicide Proof without over shelf. Units shall be of welded construction of 1/8" thick steel with paint finish.

Provide mounting bracket embed and coordinate locations with masonry subcontractor. Match dimensions of backplate to embed +/- 1/6".

4.21 SECURITY DOCUMENT PASS (ITEM 36 - FURNISH IN DEC CONTRACT)

- A. Document pass shall be through wall metal painted as detailed.

4.22 STEEL CUFF BARS 18" -ITEM 34 - FURNISH IN DEC CONTRACT

- A. Galvanized steel cuff bars as detailed painted. Anchor to masonry walls with expansion anchors and tamper proof anchor bolts.

4.23 ANTI LIGATURE SHOWER SEAT - ITEM 42

- A. S-6510-SS Anti Ligature Shower Seat by Brey/Krause Mfg, Basis of Design: It is fabricated from 11 gauge satin-finish 304 series stainless steel and is 16" deep and 32" wide. It has been load tested to over 500 pounds. The sides of the seat are fabricated from 1.25" satin-finish stainless steel tubing. The seat projects 18.125 inches from the wall and is 12.875 inches high. It attaches to the wall using 12 fasteners (not included).

4.24 FABRICATION

- A. General fabrication requirements: Remove burrs from sheared edges of metal work, east corners and smooth to eliminate cutting hazard. Bend sheets of metal at not less than minimum radius required to avoid grain separation in the metal. Maintain flat, smooth surface without damage to finish. Fabricate work from single sheet to minimize seaming.
- B. Shop Painting: Clean and prepare metal surface to be painted. Remove rust and dirt. Apply treatment to zinc-coated surfaces which have not been mill-phosphatized. Coat welded and abraded areas of zinc-coated surfaces with galvanized repair and paint. Apply primer coat in accordance with manufacturer's recommendations. Finish paint to be by general contractor or others.

4.25 EXECUTION

- A. Installation of Units Required: Install units at location shown. Comply with manufacturer's instructions. Set units plumb and level, using non-corrosive metal shims as required.
- B. Anchor with security type fasteners to wall and/or floor. Use expansion shields at solid construction, through wall bolts and back-up plates at hollow construction, and metal embeds where specified and/or detailed.
- C. Complete field assembly joints in the work (joints which cannot be completed in shop) by welding. Grind weld smooth and restore finish. Shield paint finished from welding splatter.
- D. Coordinate with other General Contractors for detention furnishings built into other work.
- E. Coordinate for caulking at perimeters of all devices to embeds and embed to finish wall with security caulking by general contractor.

4.26 ADJUST AND CLEAN

- A. Cleaning: Immediately after erection, clean field welds, bolted connections, and abraded areas. Remove protective coverings, if any.
- B. Painting: Touch up exposed areas of prime painted surfaces with same materials as used for shop drawings. Finish painting is to be by the general contractor.
- C. Polishing: Buff exposed stainless steel finishes lightly, using power buffer and polishing rought or grit or No. 400 or finer.

PART 5 SECURITY GLASS AND GLAZING

5.01 GENERAL

- A. Related Documents:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Work of this section shall conform to the requirements of the Contract Documents, including the General Conditions, Supplementary General Conditions, Special Conditions and Division 1 General Requirements. Construction Managers specific requirements apply to this section.
 2. Standard Metal Doors and Frames
 3. Detention Doors and Frames
 4. Glazing of Steel Windows
- B. Description: Furnish all labor, materials, tools, equipment necessary to complete all security glass and glazing work shown on the drawings and as specified herein.

5.02 SUBMITTALS:

- A. Manufacturers Data: Include glass manufacturer's printed literature for setting and sealing materials and for installation of each type of glazing material specified.
- B. Samples: One, 10 inches square, factory labeled, for each type of glass specified.
- C. Certificates of Compliance: Certify or label each product to indicate that materials meet specified requirements. All fire rated security glazing at required openings shall bear a UL label. Glass manufacturer / DEC and the hollow metal manufacturer shall furnish within 24 hours of the time proposals are submitted affidavits from each certifying that glazing components (glass and hollow metal) shall be capable of bearing a UL label as called for on each fire rates assembly. Non-compliance will constitute grounds for rejection of any General Contractor's proposal. Any requirements necessary to meet the intent of this qualification after bidding shall be accomplished by the DEC and glass manufacturer at no cost to the Owner. Hollow metal and glazing manufacturers will be held accountable for the assurance of this requirement. However, the hollow metal manufacturer and glass manufacturer shall indicate any specified fire rated openings that cannot be fire labeled and reasons why they cannot. If the designer furnishes the name of an approved manufacturer who can supply the fire labeled openings in questions, the manufacturer shall be required to furnish the openings with fire labels at no additional cost. However, if label openings are not available as designed, the designer shall either authorize the necessary changes in opening design, hardware, glass and/or other features which will bring the openings into compliance or drop the fire labeling requirement on openings in question. Manufacturing any openings as "Label Construction" without factory applied fire labels shall be unacceptable.

5.03 ACCEPTABLE MANUFACTURERS

- A. Except as otherwise specified herein, the equipment and materials of this Section shall be products of the following manufacturers:
 1. Advanced Glass System Corp., Trumbauersville, PA
 2. G. E. Cranford, NJ
 3. Sheffield Plastics, Sheffield, MA
 4. Global Security Glazing, Selma, AL
- B. Glass Type Schedule
 1. Type A - 1/4" Tempered Glass
 2. Type B - See Standard Glazing
 3. Type C - See Fire Rated Impact Glazing
 4. Type D - 1/2" Monolithic Transparent Polycarbonate
 5. Type E - 3/8" 1-Ply Transparent Polycarbonate
 6. Type F - 1/2" 3-Ply Transparent Polycarbonate
 7. Type G - 5/16" Laminated Fire Rated Glazing
- C. All chemically strengthened glass must meet an ASTM C-1048-85 module of rupture testing. Glass must have a strength of at least 30,000 P.S.I.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- D. All heat-strengthened glass must have an ASTM C-1048-85 with a surface compression level of 3,500 to 10,000 P.S.I.
- E. Provide (2) 4" x 4" samples of each security glass product specified.
- F. Physical Characteristics:
 - 1. Type A – 3/8" thick full tempered, condition A (uncoated surfaces), Type I (Transparent glass, flat), Class 1 (clear quality Q3 glazing select).
 - 2. Type B– Storefront, Insulated Glazing – 1/4" clear glass outboard, 1/2" airspace, 1/4" clear glass inboard. Tempered as required.
 - 3. Type C – 1/4" thick monolithic transparent polycarbonate sheet with a mar-resistant coating on both sides.
 - 4. Type D – 3/8" thick monolithic transparent polycarbonate sheet with a mar-resistant coating on both sides.
 - 5. Type E – A two-ply 3/8" total thickness polycarbonate laminate consisting of a 3/16" mar-resistant cap sheet, .025" urethane interlayer and 3/16" mar-resistant cap sheet similar and equal to ViraGuard LPC375.
 - 6. Type F – A three-ply 1/2" total thickness polycarbonate laminate consisting of a 1/8" mar-resistant cap sheet, .025" urethane interlayer, 1/4" polycarbonate, .025" urethane interlayer and a 1/8" mar-resistant cap sheet similar and equal to ViraGuard LPC500.
 - 7. Type G – A four-ply 1-1/4" total thickness polycarbonate laminate consisting of a 1/8" mar-resistant cap sheet, .025" urethane interlayer, 1/2" polycarbonate, .025" mar-resistant interlayer, 1/2" polycarbonate, .025" urethane interlayer and a 1/8" mar-resistant cap sheet similar and equal to ViraGuard LPC 1250.
 - 8. Type H – 1/4" clear monolithic pebble finish (obscure) polycarbonate sheet.
- G. Manufacturer's Guarantees: Guarantee glass units against development of material obstruction to vision as a result of delamination, other than through glass breakage, within a 5-year period following shipment of the glass. Provide new units for any units failing to comply with terms of this guarantee within 45 working days after receipt of notice from the Owner.

5.04 DELIVERY AND STORAGE:

- A. Deliver products to the site in unopened containers, labeled plainly with manufacturer's names and brands. Store glass and setting materials in safe, dry locations and do not unpack until needed for installation. Handle and install materials in a manner that will protect them from damage.
- B. Protect glass and glazing materials during delivery, storage and handling to comply with manufacturer's direction and as required to prevent edge damage to glass, and damage to glass and glazing materials from the effects of moisture including condensation, of temperature changes, of direct exposure to sun, and from other causes.

5.05 QUALITY ASSURANCE:

- A. Glazing standard: Comply with recommendations of Flat Glass Marketing Association (FGMA) "Glazing Manual" and "Sealant Manual" except where more stringent requirements are indicated. Refer to those publications (latest edition) for definitions of glass and glazing terms not otherwise defined in this section or other referenced standards.
- B. Safety Glazing Standard: Where safety glass is indicated or required by authorities having jurisdiction, provide type of products indicated which comply with ANSI Z97.1 and testing requirements of 16 CFR, part 1201 for category II materials.
- C. Fire-Resistance-Rated Wire Glass and Security Fire Rated Glazing: Provide wire glass products that are identified to those tested per ASTM E163 (UL 9) and are labeled and listed by UL or other testing and inspecting agency acceptable to authorities having jurisdiction. All fire rated security glazing shall bear a UL label. For additional information regarding fire rated openings.

5.06 WARRANTY

- A. Manufacturer's warranty on laminated glass and polycarbonate: Provide written warranty signed by manufacturer of laminated glass agreeing to furnish f.o.b. point of manufacture, freight allowed project site, within specified warranty period indicated below, laminated glass units which develop manufacturing defects. Manufacturing defects are defined as edge separation delamination, or materially obstructed vision through glass. Warranty period for each type of laminated glass shall be as follows:
 - 1. Laminated safety glass: manufacturer's standard but not less than 4 years after date of shipment.
 - 2. Laminated security compositional glass: manufacturer's standard but not less than 1 year after date of shipment.

5.07 INSTALLATION

- A. Glazing Sealants:
 - 1. General: Comply with recommendation of sealant and glass manufacturers for selection of glazing sealants which have performance characteristics suitable for applications indicated and conditions at time of installation.
 - 2. Compatibility: Select sealants with proven compatibility with surfaces contacted in the installation and under service conditions indicated, as demonstrated by testing and field experience.
- B. Silicone glazing sealant: Single component elastomeric silicone sealant complying with FS TT-S-001543, Class A, nonsag; and with ASTM C920, Type S, Grad NS, Class 25, Use G and, as applicable to use indicated, Uses A and O; and with the following requirements:
 - 1. High-modulus silicone glazing sealant: manufacturers standard high-modulus acid-curing sealant.
- C. Preformed Buyl-polyisobutylene Glazing Tape: Blend of butypolyisobutylene rubber with solids content of 100%, in extruded tape form, complying with AAMA 807.1, packaged in rolls with a release paper on side, with or without continuous spacer rod as recommended by manufacturers of tapes and glass for application indicated.

5.08 MISCELLANEOUS GLAZING MATERIALS

- A. Compatibility: Provide materials with proven record of compatibility with surface contracted in installation.
- B. Cleaners, primers, and sealers: Type recommended by sealant or glass manufacturer.
- C. Setting blocks: Neoprene, EPDM or silicone blocks as required for compatibility with glazing sealants, 80 to 90 Shore a durometer hardness.
- D. Edge block: Neoprene, EPDM or silicone blocks as required for compatibility with glazing sealant, of size and hardness required to limit lateral movement (side-walking) of glass.

5.09 INSPECTION

- A. Require Glazier to inspect work of glass framing erector for compliance with manufacturing and installation tolerances, including those for size, squareness, offsets at corners; for presence and functioning of weep system; for existence of minimum required face or edge clearances; and for effective sealing of joinery. Obtain Glazier's written report listing conditions detrimental to performance until unsatisfactory conditions have been corrected.

5.10 PREPARATION:

- A. Clean glazing channels and other framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to substrates. Remove lacquer from metal surfaces where elastomeric sealants are indicated for use.

5.11 GLAZING GENERAL:

- A. Comply with combined printed recommendations of glass manufacturers of sealants, gaskets and other glazing materials, except where more stringent requirements are indicated, including those referenced glazing standards.
- B. Glazing stop dimensions as detailed by supplier to provide for 1" bite on glass minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. General Contractor must comply with manufacturer's recommendations and coordinate with hollow metal details.
- C. Protect glass from edge damage during handling and installation; use a rolling block in rotating glass units to prevent damage to glass corners. Glass shall not impact metal framing. Use suction cups to shift glass units within openings; do not raise or shift glass with a pry bar. Rotate glass with flare or bevels along one horizontal edge which would occur in vicinity of setting blocks so that these are located at top of opening. Remove from project and dispose of glass units with edge damage or other imperfections of kind that when installed, weakens glass and impairs performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by sealant-substrate testing.

5.12 GLAZING

- A. Install setting blocks of proper size in sill rabbet, located one quarter of glass width for each corner, but no closer than 6" unless otherwise required. Set blocks in thin course of sealant which is acceptable for heel bead use.
- B. Provide edge blocking to comply with requirements of referenced glazing standard, except where otherwise required by glass unit manufacturer.
- C. Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.
- D. Provide compressible filler rods or equivalent back-up material, as recommended by sealant and glass manufacturers to prevent sealant from extruding into glass channel weep systems and from adhering to joints back surface as well as control depth of sealant for optimum performance, unless otherwise indicated.
- E. Force sealants into glazing channels to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.
- F. Tool exposed surfaces of sealants to provide a substantial "wash" way from glass. Install pressurized tapes and gaskets to protrude slightly out of channel, so as to eliminate dirt and moisture pockets.

5.13 PROTECTION AND CLEANING

- A. Protect exterior glass from breakage immediately upon installation by use of crossed streamers attached to framing and held away from glass. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection contaminating substances do come into contact with glass, remove immediately by method recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less often than once a month, for build-up of dirt, scum, alkali deposits or staining. When examination reveals presence of these forms of residue, remove by method recommended by glass manufacturer.
- D. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.

- E. Wash glass on both faces not more than 4 days prior to date scheduled for inspections intended to establish data of substantial completion in each area of project. Wash glass by method recommended by glass manufacturer.

PART 6 - HOLLOW METAL FIXED WINDOWS

6.01 HOLLOW METAL FIXED WINDOWS

A. Materials

- 1. Windows shall be constructed of commercial quality, cold rolled steel which complies with ASTM #A366-72 (1979). In either case, the steel shall be free of scale, pitting, coil breaks or other surface defects. Metal thickness shall be 12-gauge minimum.
 - a. Manufacturers with prior approval include: (Substitutions will be considered prior to bid only after submission and approval of substitution request by the Architect).
 - 1) Republic Doors and Frames, Basis of Design of approved equivalent.
 - 2) Amweld Building Products, Inc.
 - 3) Ceco Corp.
 - 4) Copco Door Co.
 - 5) Curries Company.
 - 6) Deansteel Manufacturing Co.
 - 7) Fenestra Corp.
 - 8) Kewanee Corp.
 - 9) Mesker Door Co.
 - 10) Pioneer Industries.
 - 11) Premier Products, Inc. (Formerly Dittco).
 - 12) Steelcraft Manufacturing Co.

B. Construction

- 1. All window frames shall be custom made, welded units of the sizes and types shown on contract drawings.
- 2. All finished work shall be strong and rigid, neat in appearance, square and free of defects, warps or buckles. Pressed steel members shall be straight and of uniform profile throughout their lengths.
- 3. Jamb, header, middle mullion (with internal round bar) and sill profiles shall be as detailed and scheduled by the architect and shown on the approved submittal drawings.
- 4. Corner joints shall have all contact edges closed tight with faces mitered and stops either butted or mitered. Corner joints shall be continuously welded and the use of gussets or splice plates will be unacceptable.
- 5. Minimum depth of glazing stops shall be 5/8", and in glass panel openings shall be 1". Cut-off stops, where shown, shall be capped at 45 degrees or 90 degrees at heights shown on approved submittal drawings and jamb joints below cut-off stops shall be welded, filled and ground smooth such that there are no visible seams.

C. Anchors

- 1. Frames for installation in masonry walls shall be provided with adjustable jamb anchors of the yoke and strap type made from the same gauge steel as frame. Straps shall extend a minimum of 8" from the outside perimeter of the frame and shall be at least 2" wide, corrugated and/or perforated.

- D. Grout guards for stop screws made from no less than 26-gauge steel shall be welded in place on all windows to be set in masonry or concrete openings.

E. Loose Glazing Stops

- 1. Glass stops shall be matched drilled and held in place by two (2) Phillips head screws. The screw holes in the loose stops will be 1/8" larger than the diameter of the screw to allow for adjustment.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. In openings where security glass is specified, pressed steel angle glazing stops no less than 10-gauge shall be furnished installed in the frame, all screws in place. Angle stops shall be mitered and tight fitting at the corner joints and secured using 1/4 - 20 drive grade #8, button head, self-tapping screws spaced 9" O.C. maximum. Glass stop system shall be certified to meet the testing criteria outlined in the performance section "Glazing Stops Test". All self-tapping screws shall be shipped loose to the DSCF's office.
3. All glass stop screws shall be protected from grout by plastic screw covers secured to screw with adhesive or caulk or continuous channel covering all screws and welded in place.
4. The frame underneath the glazing stops and the inside of the glazing stop shall be chemically treated for maximum paint adhesion and painted with a rust-inhibitive primer prior to installation in the frame in accordance with Paragraph F – "Finish".

F. Finish

1. After fabrication, all tool marks and surface imperfections shall be removed and exposed faces of all welded joints shall be dressed smooth. Frames shall be chemically treated to insure maximum paint adhesion and shall be coated on all accessible surfaces with a rust-inhibitive primer which meets or exceeds ASTM #B117-73 (1979) salt spray for 150 hours and ASTM #D173562 (1980) water fog test for organic coatings for 200 hours. Paint shall be fully cured prior to shipment.

6.02 WOVEN SECURITY MESH AND FRAMES

- A. Acceptable Manufacturers: (Except as otherwise specified herein, the equipment and materials of this Section shall be products of the following manufacturers:
 1. Kane Manufacturing, Kane, PA
 2. Majestic Solution, Huntsville, AL.
 3. WireCrafters LLC, Louisville, KY
- B. Product shall consist of a tubular main frame, woven rod panels, concealment plates and other fittings to make a complete unit either fixed or operating type.
- C. Main Frame
 1. The main frame shall be built-up tubular type, measuring 1-1/2" x 2-1/2" consisting of an open channel with fixed concealment plates. The open channel elements shall be formed of 12-gauge sheet steel and shall have individual slots along the inner edges to support the woven rod panel(s). Before installing the woven rod panel(s), the corners of the open channel elements shall be electric arc welded and ground smooth. Braces (similar to the main frame) shall be furnished as scheduled.
- D. Woven Rod Panels
 1. Woven rod panels shall be fabricated from double crimped, 3/8" wire x 2" O.C. low carbon mild steel rod. Woven rod panels shall be installed symmetrically in the main frame. Each individual rod shall be welded into each slot where it contacts the main frame.
- E. Concealment Plates
 1. Concealment plates of 12-gauge sheet steel shall be applied to the back of the main frame to complete the tubular shape. Concealment plates shall be welded to the main frame.
- F. Finish
 1. All finish work shall be neat and free of scale, pitting, coil breaks or other surface defects. Prior to painting, tool marks and imperfections on exposed surfaces shall be dressed clean by grinding, filling and sanding.
 2. All materials are to be cleaned with either a pressure washer having an iron phosphate conversion coating or an industrial solvent applied and wiped clean.
 3. Primed metal surfaces shall be coated with primer to a film thickness of 4 mil (+/- 1 mil).

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

G. Installation

1. Installer shall comply with the manufacturer's specifications and installation instructions.
2. Set fixed unit in place, plumb, level and true to line without warp or rack of frames. Frames are to be securely anchored in place as detailed.

6.03 SECURITY BAR GRATES

- A. Furnish and install steel security bar grates as detailed on drawings in all openings through secure perimeter (walls, floor, roof) to include duct passageways, equipment openings, fans, rough openings, etc. Bar grates need not be installed where maximum security grilles as detailed on security drawings are utilized. See security key plan for location of secure/reinforced walls.
- B. Grates shall be constructed of 3/4" smooth bars at 5-3/4" o.c. one way. Bars shall be welded in 1-1/2" x 1-1/2" x 1/4" continuous angle perimeter frame. Furnish and install in any opening greater than 6" x 6". Furnish perimeter anchor plates as shown. Fully weld grate frame to anchor plates.

END OF SECTION

SECTION 13 42 63.13

EQUIPPED PRECAST DETENTION MODULES - NIC: For Reference and Coordination

EQUIPPED PRECAST DETENTION MODULES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and any general provisions of the Contract for each Prime Contract, including General and Supplementary Conditions and specific requirements apply to this Section.

1.02 SUMMARY:

- A. This Section includes equipped precast concrete single and twin cell modules engineering, production, and delivery, including the following:
 - 1. Concrete wall, roof, and floor panels reinforced with module manufacturer's standard reinforcing steel in detention system configuration.
 - 2. All Metal inserts, plates, anchors, etc. as required and shown on drawings for contiguous construction.
 - 3. Security doors, windows, access doors, hardware, equipment, furnishings, Telemedicine devices and accessories as required in wall and floor mounted configurations as depicted on drawings.
 - 4. Security and conventional caulking and sealants at all interior surfaces to include concrete to concrete, concrete to metal, and concrete to furnishings, fixtures and equipment.
 - 5. Interior and exterior module finishes (exterior paint ready for job applied elastomeric coatings by Division 9 exterior face of modules (fronts) and metal fabrications will be completed on site by Division 9).
 - 6. HVAC security grilles, diffusers, and accessories. NOTE: All HVAC ductwork and accessories at chases shall be completed at site by on site Bid Package contractor.
 - 7. Plumbing piping, equipment, fixtures, devices, and accessories. NOTE: All water piping connection and installation at chases shall be completed at site by Bid Package on site contractor. Note: PCMC will furnish all fixture devices, valves, etc. to plumbing subcontractor for installation at site in chases as required.
 - 8. Fire sprinkler sleeve (2" blackout) provided by PCMC. Fire sprinkler head supplied and installed by others.
 - 9. Electrical distribution conduit, wiring, fixtures, switches, receptacles, data and power and all interface to house electrical and other devices as required.
 - 10. Electronic Security system support, conduit & boxes and installation, as required to accommodate all devices and their interface.
 - 11. Telemedicine System support, conduit & boxes and installation, as required to accommodate all devices and their interface.
- B. Related Sections: the following sections contain requirements that relate to this Section.
 - 1. Cast-in-place concrete is specified in Division 3 Section "Cast-In-Place Concrete."
 - 2. Joint sealants and backing are specified in Division 7 "Moisture Control".
 - 3. Applied finishes are specified in Division 9 Sections.
 - 4. Interfacing Mechanical systems and insulation are specified in Division 23 sections. (80% specifications available on request)
 - 5. Interfacing Electrical systems are specified in Division 26 sections.
 - a. (80% specifications available on request)
 - 6. Interfacing Security Control Systems are specified in Division 28 sections.
 - a. (80% specifications available on request)

1.03 SUBMITTALS:

- A. General: Submit the following according to Conditions of Contract as required for prior approval.
- B. Product data and instructions for manufactured materials and products. Include manufacturer's certifications, structural calculations and laboratory test reports as required.

CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
DETENTION MODULE PACKAGE
ANNISTON, ALABAMA

- C. Mix design reports of proposed concrete mix as specified in Part 2 of this Section.
- D. Shop drawings prepared by or under the supervision of a qualified professional engineer, registered in the State of Alabama (with seal) showing complete information for fabrication and installation of precast detention module units. Indicate member dimensions and cross-section; location, size, and type of reinforcement, including special reinforcement, pin setting engineering, and lifting devices necessary for handling, erection, and connection of other structural elements. Provide piping, conduit, box, sleeve, insert and embed shop placement drawings indicating the coordination of all required materials. Provide line voltage and control wiring diagrams for all required devices.
- E. Provide complete design calculations indicating all applicable loads, member forces, member stresses, and reactions related to the main structure. Use design loads as indicated on Structural Documents.
- F. Note: See Structural drawings for required weld plate and miscellaneous anchor coordination for Seismic Group II. Anchor module to module and module to main structure as required and as verified by PCMC, Structural Engineer of Record.
- G. Provide catalog data with full performance criteria and dimensions for components purchased from outside sources including but not limited to embedded items required for connection to the main structure.
- H. Samples of recommended bearing pads, setting pins, etc.
- I. Shipping, lifting, and handling diagrams indicating point loads and net and gross loads.
- J. Test reports as required provisions of this Section.

1.04 QUALITY ASSURANCE:

- A. Codes and Standards: Comply with provisions of following codes, specifications and standards, except as otherwise indicated:
 - 1. ACI 301, "Specifications for Structural Concrete for Buildings."
 - 2. ACI 318, "Building Code Requirements for Reinforced Concrete."
 - 3. AWS S1.1, "Structural Welding Code: Steel."
 - 4. Concrete Reinforcing Steel Institute, "Manual of Standard Practice."
 - 5. Prestressed Concrete Institute MNL 116, "manual for Quality Control for Plants and Precast Concrete Products."
 - 6. 2015 International Building Code.
- B. Fabricator PCMC (Prefabricated Cell Module Contractor) Qualifications: Firm experienced in fabrication of precast concrete modules similar to units required for this Project and that have a record of successful in-service performance, with sufficient production capacity to produce required units without causing delay in work. Acceptable (not approved) Manufacturers are as follows:
 - 1. Precast Concrete Modules
 - a. Tindall Corporation, 3361 Grant Road, Conley, GA 30288
 - b. Oldcastle, Inc., 375 Northridge Road, Atlanta, GA 30350
 - c. Cornerstone Detention, 14000 Highway 20, Madison, AL 35756
 - d. The above manufacturers will be approved contingent on meeting all prior approval requirements and specifically those of par. 1.04 e. The above listing does not constitute prior approval.
- C. Design by Fabricator (PCMC): Design units to support all superimposed dead loads, and live loads, and lateral loads as indicated on drawings and as required for compliance with local governing code requirements. Design shall also provide for loads imposed by source-to-site shipping and handling. Design calculations shall clearly indicate application of the required loads.
- D. Fabrication (PCMC) Qualifications: Produce precast concrete units at prior approved fabricating plant engaged primarily in manufacturing of similar units.

CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
DETENTION MODULE PACKAGE
ANNISTON, ALABAMA

- E. Provide professional certification of the integrated design by structural engineer properly licensed in the state where the work will finally reside. Certification of fully integrated design includes proof of compliance with all portions of this Division 13 and assurance that all systems specified herein and in all other Divisions of this Specification are interfaced completely with modules for a fully installed, fully working facility in every respect. PCMC manufacturer / vendor / Contractor will provide full certification by State of Alabama Modular Housing with all seals and affidavits of approval.
- F. This requirement also includes integration of any manufacturer's unit into the physical floor plan, sections, elevations and structural design of the facility. Those manufacturers meeting exact physical dimensions and structural characteristics of those units specified herein and detailed are required to certify the same in writing to the Architect for prior approval at least 10 days prior to bidding.
- G. Those manufacturers whose units vary in physical size and structural characteristics must provide the Architect with engineering shop drawings and design calculations of the same five days prior to bidding as a requirement for prior approval. Engineering drawings and design calculations must demonstrate in dimension, detail, and analysis that the units in question can be integrated into the facility design without unnecessary reconfiguring of design including square footage of cells, dayspaces, outside wall locations and, structural loading or modification which would create additional load bearing columns, walls or beams and supporting footings. Cost for any redesign required by the above shall be borne by the PCMC.
- H. Any manufacturer which fails to demonstrate this integration satisfactorily to the A/E will not be approved.
- I. In addition, any failure by PCMC's to satisfactorily integrate module units into facility design and to coordinate for the same in all proposals will not be accepted as a basis for Change Order or other compensation adjustment after bidding or Contract execution.
- J. Fire-Resistance Rated Precast Units: Where precast concrete units are shown or scheduled as requiring fire-resistance classification, provide units of design or assemblies tested and listed by Underwriters Laboratories, Inc. (UL) in "Fire Resistance Directory" or in accordance with applicable building code approved assemblies or construction materials. Fire rated performance criteria for all units must meet current IBC building code.
- K. Perform concrete testing in accordance with ASTM C31, C183, C143, C172, and C173, with minimum of four test cylinders per 25 cubic yards of concrete or portion thereof cast on a given day. Provide test reports in a timely manner to the Architect.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver the amount of units needed in a timely manner to the Project site to ensure installation continuity.
- B. Store and handle the units at the Project site to prevent cracking, distortion, staining, or other physical damage, and so that markings are visible. Lift and support units at designated lift points.
- C. Provide setting diagrams, templates, instructions, and directions, as required, for installation. This PCMC will coordinate at the site all setting pin locations to include engineering and layout with the Owner's General Works General Contractor and the Construction Manager. That Contractor will thin drill and provide for setting pins as required.
- D. Coordinate delivery closely with General Contractors performing related work. Deliver products within 2 hours of scheduled time.

PART 2 - PRODUCTS

2.01 FORMWORK:

- A. Provide forms and, where required, form facing materials of metal, plastic, wood, or another acceptable material that is nonreactive with concrete and will produce required finish surfaces.

CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
DETENTION MODULE PACKAGE
ANNISTON, ALABAMA

- B. Accurately construct forms, mortar-tight, of sufficient strength to withstand pressures due to concrete placing operations, temperature changes, and for prestressed, pre-tensioning, and detensioning operations. Maintain formwork to provide completed precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified in PCI MNL 116 and as required for appropriate installation of security items such as slider devices, doors, frames, window and detention equipment and furnishings, etc.
- C. Unless forms for plant-manufactured prestressed concrete units are stripped prior to detensioning, design forms so that stresses are not induced in precast units due to deformation of concrete under prestress or movement during detensioning.

2.02 REINFORCING MATERIALS:

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Low-Alloy Steel Reinforcing Bars: ASTM A 706.
- C. Steel Wire: ASTM A 82, plain, cold-drawn steel.
- D. Welded Wire Fabric: ASTM A 185.
- E. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing, complying with CRSI recommendations.
 - 1. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs that are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).

2.03 CONCRETE MATERIALS:

- A. Portland Cement: ASTM C 150, Type I or Type II.
- B. Use only brand and type of cement throughout Project, unless otherwise acceptable to Architect.
- C. Aggregates: ASTM C 33, and as specified here. Provide aggregates from a single source for exposed concrete.
 - 1. Local aggregates not complying with ASTM C 33, but that have shown by special test or actual service to produce concrete of adequate strength and durability, may be used when acceptable to Architect.
- D. Lightweight Aggregate: ASTM C 330.
- E. Water: Potable
- F. Admixtures, General: Provide admixtures for concrete that contain not more than 0.1 percent chloride ions.
- G. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- H. Water-Reducing Admixture: ASTM C 494, Type A, or other Type approved for fabricator's units.

2.04 CONNECTION MATERIALS:

- A. Steel Plates: Structural quality, hot-rolled carbon steel, ASTM A 283, Grade C.
- B. Steel Shapes: ASTM A 36.
- C. Anchor Bolts: ASTM A 307, low-carbon steel bolts, regular hexagon nuts, and carbon steel washers.
- D. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, and hardened washers complying with ASTM A 325.
- E. Finish of Steel Units: Exposed units galvanized per ASTM A 153; others painted with rust-inhibitive primer.
- F. Welding Electrodes: Comply with AWS standards.

CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
DETENTION MODULE PACKAGE
ANNISTON, ALABAMA

- G. Accessories: Provide clips, hangers, and other accessories required to install project units and to support subsequent construction or finishes.
- H. Masonry Anchors: Provide 24 gauge galvanized continuous dovetail slots as required where masonry walls adjoin or as detailed in contract documents.
- I. Threaded Inserts: Provide inserts for connection of reinforcing bars capable of achieving 1.5 times the tension capacity of the bar being connected. Refer to structural drawings for size and applied loads.

2.05 MIX PROPORTION AND DESIGN:

- A. Prepare design mixes for each type of concrete required.
- B. Design mixes may be prepared by independent testing facility or by qualified precast manufacturing plant personnel at precast manufacturer's option.
- C. Proportion mixes by either laboratory trial batch or field experience methods using materials to be employed on the Project for each type of concrete required complying with ACI 318.
 - 1. Produce standard-weight concrete consisting of specified portland cement, aggregates, admixtures, and water to produce the following properties:
 - a. Compressive strength-5000 psi minimum at 28 days.
 - b. Release strength for prestressed units-3500 psi.
 - 2. Produce lightweight concrete consisting of specified portland cement, aggregates, admixtures, and water to produce the following properties.
 - a. Compressive strength-5000 psi minimum at 28 days.
 - b. Air-dry density-not less than 90 nor more than 115 lb. per cu. ft.
 - c. Release strength for prestressed units-3500 psi.
 - 3. Cure compression test cylinders using same methods as for precast concrete work.
- D. Submit written reports to the Architect of proposed mix for each type of concrete at least 15 days prior to start of precast unit production. Do not begin concrete production until mixes and evaluations have been reviewed by Architect.
- E. Adjusting Concrete Mixes: Mix design adjustments may be requested when characteristics of materials, job conditions, weather, test results, or other circumstances warrant. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by Architect and Fire Protection engineer before using in the Work.
- F. Admixtures: Use air-entraining and admixture in concrete, unless otherwise indicated.
 - 1. Use water-reducing admixtures in strict compliance with manufacturer's directions. Admixtures to increase cement dispersion, or provide increased workability for low-slump concrete, may be used subject to Architect's acceptance.
 - 2. Use amounts as recommended by admixture manufacturer for climatic conditions prevailing at time of placing. Adjust quantities of admixtures as required to maintain quality control.

2.06 SECURITY DOORS, SECURITY WINDOWS, CHASE DOOR, SECURITY HARDWARE AND ACCESSORIES:

- A. Steel Security Frames: 12-gauge hollow metal, factory prepared for required hardware. See door and hardware schedule. Security frames shall be cast with #4 or larger anchors not less than 24" o.c. factory prepared. Frames shall be fully formed in concrete casting process or shall be fully grouted. See Door and Hollow Metal schedule. Hollow metal swing doors, these openings will be furnished by PCMC as scheduled.
- B. Access Doors and Frames: 3/16" plate hollow metal, cast in cell wall with #3 welded bar anchors. Provide full seal where required for air-tight return.
- C. Security Hardware:
 - 1. For Cell Doors swing hardware prep at hollow metal shall be in accordance with door schedule. Hardware furnished and installed by Div. 11 with exception of door hinges. Hinges provided and installed by PCMC.

CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
DETENTION MODULE PACKAGE
ANNISTON, ALABAMA

2. Chase Access Doors at Cells in accordance with Security drawings and schedules.

D. Security Windows:

1. PCMC will furnish and install steel security windows as detailed and specified in Division 11, Section 11010, Part 6, conforming to criteria and wind loading requirements.

2.07 CAULKING AND SEALANTS:

A. Exterior caulking shall be a two part, dymeric polysulfide by Tremco or equal. Exterior caulking by GC.

B. Interior: All interior cell joints to be caulked with Dynaflex SC or equal, with exception of joints between glazing and frames. These joints to be sealed with Silglaze II or equal.

2.08 MODULE FINISHES:

A. Cell Floors: Smooth surface Trowel finish by PCMC ready to receive Polished Concrete Finishing by GC.

B. Concrete Cell Walls/Ceilings: Modules cast at plant with natural concrete finish as follows:

C. 1. Lightly abrade all surfaces to expose irregularities. Install cementitious blockfill equal to Amercoat 965. Ensure this plant finish is acceptable for exposed wall surface or finish painting at site. Provide submittals and actual 2'0" x 2'0" sample for approval, if required.

D. All Interior and Exterior Steel to include Grilles and Registers: 1 coat Sherwin Williams Loxon Primer, or equal, and 1 coat Amerlock 2 VOC finish at plant. Finish coating over grilles and registers to match wall coating.

E. Exterior Exposed Walls: Steel form finish.

2.09 SPECIALTY ITEMS AND FURNISHINGS:

A. See Drawings A10.3 / Security / Detention Furnishings/Fixture Schedule. Furnish all items as scheduled and specified.

2.10 HVAC EQUIPMENT

A. Supply, return and exhaust duct in chase shall be installed at site by on site Bid Package Mechanical contractor under General Works General Contractor contract. Coordinate final size and configuration of all ducts, fire dampers, etc. with Division 23.

B. Security grilles and diffusers by Anemostat or equal. See details. Coordinate for final number, location and size of all grilles and diffusers with Division 23. NOTE: All grilles, registers and other exposed metal devices will be plant painted by the PCMC in accordance with requirement of Division 9, Section 09 91 00: Painting.

C. Exterior Duct-Wrap Insulation at chases shall be installed at site by Division 23 Bid Package contractor.

2.11 PLUMBING EQUIPMENT AND FIXTURES

A. Drain, waste and vent piping at chases shall be Tyler Ruf-wall or equal (no-hub, cast iron) installed in chase on site by Bid Package Plumbing contractor. All floor drains within the cells shall be furnished and installed by the PCMC as detailed.

B. Combination stainless steel toilet/lavatory unit installed in housing unit cells shall be Acorn Penal-Ware 1415 Series 15" Lav-Toilet Comby with Lavatory multi sided bowl or prior approved equivalent. Integral to the fixture will be recessed paper holder, soap dish, seat, sink drain extension with bubbler and overflow protection. Security wall sleeve to be cast into Precast Module. Flush valve and hot/cold water adjustable metering valves furnished to project site by PCMC to plumbing subcontractor for installation in chase. Note: PCMC will furnish specified ADA security fixtures where shown.

C. Fixture is arranged to be installed on finished wall and serviced from an accessible pipe chase. Optional Wall Sleeve or Metal Template is recommended for all installations for required wall openings. Fixture is fabricated from 14 gage, type 304 stainless steel cabinet and toilet bowl and is seamless welded construction with a satin finish. The inside of the toilet bowl also has a

CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
DETENTION MODULE PACKAGE
ANNISTON, ALABAMA

satin finish. Cabinet interior is sound-deadened with fire-resistant material. There are no accessible voids or crevices where contraband can be concealed.

1. Lavatory Multi-Sided Bowl is 12-3/4" x 8-1/4" x 5" deep. Standard elbow waste outlet is 1-1/2" O.D. plain end.
 2. Optional Valve may be an Air-Control pneumatically operated, pushbutton valve using atmospheric air. Pushbutton is vandal-resistant and requires less than 5 pounds to activate valve. Valve is direct acting, non-metering type and is optionally available as metering with non-hold open feature. Metering valve timing is adjustable from 5 to 60 seconds. Valve includes a 0.5 GPM flow control and can be remotely located up to 10 feet from the operating pushbutton. Valve and bubbler conform with lead free requirements for NSF61, Section 9 and CHSC 116875.
 3. Toilet is blowout jet type with elongated bowl manufactured to ASME A112.19.3 and CSA B45.4 requirements and will flush with a minimum of 25 PSI flow pressure when used in conjunction with a minimum of 1.28 gpf. Trap has a minimum 3-1/2" seal and will pass a 2-1/8" ball. Toilet waste outlet is 2-3/8" diameter plain end extending 3" beyond the fixture for wall outlet or Gasketed Waste for floor outlet.
 4. Regularly Furnished items include a fast drain, integral raised soap ribs, and mounting hardware.
- D. Provide and install Acorn Penal-Ware® 15" wide Lav-Toilet Comby (specify model number and options). Fixture shall be fabricated of type 304 stainless steel. Construction shall be seamless welded and exposed surfaces shall have a satin finish. Countertop shall have raised soap ribs. Provide Air-control pneumatically operated pushbutton valve. Valve and bubbler conform with lead free requirements for NSF61, Section 9 and CHSC 116875. Toilet shall be concealed blowout jet type with an elongated bowl, a self-draining flushing rim, and an integral contoured seat. Toilet shall meet ASME A112.19.3 and CSA B45.4 requirements and will flush with a minimum of 25 PSI flow pressure when used in conjunction with a minimum of 1.28 gpf. Toilet trap shall have a minimum 3-1/2" seal that shall pass a 2-1/8" diameter ball and be fully enclosed. Cabinet interior is sound-deadened with fire-resistant material. Fixture shall withstand loadings of 5,000 pounds without permanent damage. Fixture shall be furnished with necessary fasteners for proper installation.
- E. Plumbing installations by PCMC and in the chase by plumbing contractor shall be in accordance with materials and practices outlined in Division 22.
- F. Combination ADA accessible units shall be as shown on drawings. Unit shall be Willoughby or equal.
- G. Insulation of plumbing piping (hot/cold water, etc.) in the chase shall be completed at the site by Division 23 Bid Package contractor.
- H. All plumbing fixtures and valves shall be capable of complete functional operation at 25 psi supply pressure.

2.12 FIRE PROTECTION:

- A. All piping at the module chase to be in accordance with NFPA and local code requirements and requirements of Division 21.
- B. Sprinkler piping heads shall be tamper proof high security institutional/correctional type as specified in Division 21, furnished and installed by GC. PCMC to provide 2" wall sleeve only.
- C. Fire Protection installation shall be in accordance with practices outlined in Division 21.
- D. Enclose any exposed room fire sprinkler piping behind concrete structure or approved 12-gauge removable closure plate secured with detention hardware at otherwise inaccessible areas.

2.13 ELECTRICAL/SECURITY SYSTEM:

- A. Security lighting fixtures to be Coordinated fully with Division 28 for final project lighting requirements. Cell module lighting fixtures provided and installed by PCMC. Wire harness for lighting fixture pulled to chase for supply connection by GC.

CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
DETENTION MODULE PACKAGE
ANNISTON, ALABAMA

- B. Electrical wireways shall be a minimum of 3/8" metallic tubing or as required by power or data cabling, embedded in concrete for fixtures and devices in cell areas and installed surface mounted where exposed in mechanical chase.
- C. Electrical switches and receptacles shall be NEMA Specification Grade with stainless steel cover plates and security type installation hardware.
- D. Control and power wiring shall be copper with insulation in accordance with NEC, provided and installed by Electrical Bid Package Contractor.
- E. All electrical installation shall be in accordance with practices outlined in Division 26 of this specification.

2.14 FABRICATION:

- A. General: Fabricate precast concrete units complying with manufacturing and testing procedures, quality control recommendations, and dimensional tolerances of PCI MNL-116 and as specified for types of units required. Integrate mechanical, electrical, plumbing, security electronics, detention equipment and hardware, Telemedicine device support and finishes in accordance with standards applicable throughout these specifications for similar or corresponding site constructed work.

2.15 SOURCE QUALITY CONTROL:

- A. The Owner may employ an independent testing laboratory to evaluate manufacturer's quality control and testing methods.
- B. PCMC shall notify Architect when modules for this project are placed in production at the plant and shall coordinate with Architect for a plant inspection visit, timed so as Architect can review module production from initial casting to final inspection of a complete module in one visit if practical.
- C. The manufacturer shall allow Owner's testing facility access to materials storage areas, concrete production equipment and concrete placement and curing facilities. Cooperate with Owner's testing laboratory and provide samples of materials as may be requested for additional testing and evaluation.
- D. Dimensional Tolerances: Units having dimensions smaller or greater than required and outside specified tolerance limits may be subject to additional testing as specified herein.
- E. Precast units having dimensions greater than required will be rejected if the appearance or function of the structure is adversely affected or if larger dimensions interfere with other construction, or if inappropriate tolerances exist for the installation of security devices with close tolerance requirements such as door frames or security slider devices. Repair or remove and replace rejected units, as required, to meet construction conditions. It shall be the responsibility of Division 11, Division 28 and Division 13 Bid Package Construction contractors to verify appropriate tolerances before any security equipment is hung from modules onsite.

2.16 MANUFACTURERS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering assembled products that may be incorporated in the Work include but are not limited to the following:
 - 1. Concrete Cell Module
 - a. Tindall Corporation, 3361 Grant Road, Conley, GA 30288
 - b. Oldcastle, Inc., 375 Northridge Road, Atlanta, GA 30350
 - c. Cornerstone Detention, 14000 Highway 20, Madison, AL 35756

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Bearing Pads: Install flexible bearing pads where indicated as precast units are being erected. Set pads on level, uniform bearing surfaces and maintain in correct position until precast units are placed.

CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
DETENTION MODULE PACKAGE
ANNISTON, ALABAMA

- B. Welding: Perform welding in compliance with AWS D 1.1 and D1.4, including qualification of welders.
 - 1. Protect units from damage by field welding or cutting operations and provide non-combustible shield as required.
 - 2. Repair damaged metal surfaces by cleaning and applying a coat of liquid galvanizing repair compound to galvanized surfaces and a compatible primer to painted surfaces.
- C. Erection Tolerances: Install precast units without exceeding tolerance limits specified in PCI MNL-127, "Recommended Practice for Erection of Precast Concrete."
 - 1. Grouting Connections and Joints: After units have been placed and secured, grout open spaces at connection and joints as follows:
 - 2. Shrinkage-resistant grout consisting of premixed compound and water to provide a flowable mixture without segregation of bleeding.
 - 3. Provide forms or other acceptable method to retain grout in place until sufficiently hard to support itself. Pack spaces with stiff grout material, rapping until voids are completely filled. Place grout to finish smooth, plumb, and level with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it hardens.
 - 4. PCMC will coordinate fully with General Works Bid Package General Contractor for setting pin engineering location, placement and setting. General Works Bid Package General Contractor will drill and/or core and assist in installation of pin and module setting.
 - 5. General Contractor to provide concrete cylinder break testing results for foundations to PCMC prior to installation of precast modules.

END OF SECTION

**CALHOUN COUNTY JAIL
ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

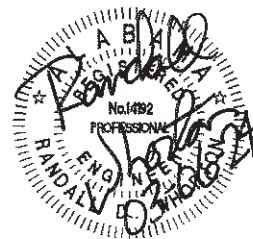
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**CALHOUN COUNTY JAIL
ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

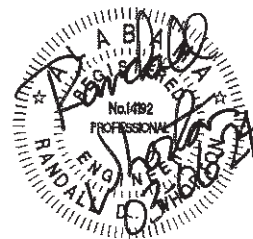
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SECTION 21 05 13 - COMMON MOTOR REQUIREMENTS FOR FIRE SUPPRESSION EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Premium efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
 - 2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 21 05 17 - SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Stack-sleeve fittings.
 - 3. Sleeve-seal systems.
 - 4. Sleeve-seal fittings.
 - 5. Grout.
 - 6. Silicone sealants.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop.
- B. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, anticorrosion coated or galvanized, with plain ends and integral welded waterstop collar.
- C. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- D. PVC Pipe Sleeves: ASTM D1785, Schedule 40.
- E. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.
- F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

- A. Description: Manufactured, Dura-coated or Duco-coated galvanized cast-iron sleeve with integral clamping flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

- A. Description:
 - 1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 2. Designed to form a hydrostatic seal of 20 psig minimum.
 - 3. Sealing Elements: Nitrile (Buna N) interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size.
 - 4. Pressure Plates: Carbon steel or Stainless steel.
 - 5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B633 or Stainless steel of length required to secure pressure plates to sealing elements.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2.4 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.
- B. Plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

- A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.6 SILICONE SEALANTS

- A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C920, Type S, Grade NS, Class 25, Use NT.
- B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.
- C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
 - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
 - 2. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 - 3. Using grout or silicone sealant, seal space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.
- E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials.

3.2 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 07 62 00 "Sheet Metal Flashing and Trim."
 3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 5. Use silicone sealant to seal around the outside of stack-sleeve fittings.
- B. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- or smoke-stop materials. Comply with requirements for firestopping.
- 3.3 SLEEVE-SEAL-SYSTEM INSTALLATION
- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
 - B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.
- 3.4 SLEEVE-SEAL-FITTING INSTALLATION
- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
 - B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
 - C. Secure nailing flanges to concrete forms.
 - D. Use grout or silicone sealant, to seal the space around outside of sleeve-seal fittings.
- 3.5 FIELD QUALITY CONTROL
- A. Perform the following tests and inspections:
 1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
 - B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.
 - C. Prepare test and inspection reports.
- 3.6 SLEEVE AND SLEEVE-SEAL SCHEDULE
- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves, Steel pipe sleeves or Sleeve-seal fittings.
 - b. Piping NPS 6 and Larger: Cast-iron pipe sleeves, Steel pipe sleeves or Sleeve-seal fittings.
 2. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves with sleeve-seal system, Steel pipe sleeves with sleeve-seal system, or Sleeve-seal fittings.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 and Larger: Cast-iron pipe sleeves with sleeve-seal system or Steel pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 3. Concrete Slabs-on-Grade:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves with sleeve-seal system, Steel pipe sleeves with sleeve-seal system, or Sleeve-seal fittings.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 and Larger: Cast-iron pipe sleeves with sleeve-seal system, Steel pipe sleeves with sleeve-seal system, or Sleeve-seal fittings.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
4. Concrete Slabs above Grade:
- a. Piping Smaller Than NPS 6: Steel pipe sleeves, PVC pipe sleeves, Stack-sleeve fittings, Sleeve-seal fittings, Molded-PE or -PP sleeves, or Molded-PVC sleeves.
 - b. Piping NPS 6 and Larger: Steel pipe sleeves, PVC pipe sleeves, or Stack-sleeve fittings.
5. Interior Partitions:
- a. Piping Smaller Than NPS 6: Steel pipe sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel sheet sleeves.

END OF SECTION

SECTION 21 05 18 - ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.
 - 2. Floor plates.

1.3 DEFINITIONS

- A. Existing Piping to Remain: Existing piping that is not to be removed and that is not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Stainless-Steel Type: With polished stainless-steel finish.
- C. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- D. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished, chrome-plated finish and spring-clip fasteners.
- E. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.
- F. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed hinge; and spring-clip fasteners.

2.2 FLOOR PLATES

- A. Split Floor Plates: Steel with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping and Relocated Existing Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
 - b. Chrome-Plated Piping: One-piece cast brass with polished, chrome-plated finish.
 - c. Insulated Piping: One-piece cast brass with polished, chrome-plated finish.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece cast brass with polished, chrome-plated finish.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece cast brass with polished, chrome-plated finish.
 - f. Bare Piping in Unfinished Service Spaces: One-piece cast brass with polished, chrome-plated finish.
 - g. Bare Piping in Equipment Rooms: One-piece cast brass with polished, chrome-plated finish.
 - 2. Escutcheons for Existing Piping to Remain:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
 - b. Bare Piping in Unfinished Service Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
- 1. New Piping and Relocated Existing Piping: One-piece, floor plate.
 - 2. Existing Piping: Split floor plate.
- 3.2 FIELD QUALITY CONTROL
- A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION

SECTION 21 05 23 - GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Two-piece ball valves with indicators.
 - 2. Bronze butterfly valves with indicators.
 - 3. Iron butterfly valves with indicators.
 - 4. Check valves.
 - 5. Bronze OS&Y gate valves.
 - 6. Iron OS&Y gate valves.
 - 7. NRS gate valves.
 - 8. Indicator posts.
 - 9. Trim and drain valves.

1.3 DEFINITIONS

- A. NRS: Nonrising stem.
- B. OS&Y: Outside screw and yoke.
- C. SBR: Styrene-butadiene rubber.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, and weld ends.
 - 3. Set valves open to minimize exposure of functional surfaces.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher-than-ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.
- D. Protect flanges and specialties from moisture and dirt.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of valve from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:
 - 1. Fire Main Equipment: HAMV - Main Level
 - a. Indicator Posts, Gate Valve: HCBZ - Level 1
 - b. Ball Valves, System Control: HLUG - Level 3
 - c. Butterfly Valves: HLXS - Level 3

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- d. Check Valves: HMER - Level 3
 - e. Gate Valves: HMRZ - Level 3
 - 2. Sprinkler System & Water Spray System Devices: VDGT - Main Level
 - a. Valves, Trim and Drain: VQGU - Level 1
 - B. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:
 - 1. Automated Sprinkler Systems:
 - a. Indicator posts.
 - b. Valves.
 - 1) Gate valves.
 - 2) Check valves
 - 3) Miscellaneous valves.
 - C. ASME Compliance:
 - 1. ASME B1.20.1 for threads for threaded-end valves.
 - 2. ASME B16.1 for flanges on iron valves.
 - 3. ASME B31.9 for building services piping valves.
 - D. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.
 - E. NFPA Compliance for valves:
 - 1. Comply with NFPA 13, NFPA 14, NFPA 20, and NFPA 24.
 - F. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher, as required by system pressures.
 - G. Valve Sizes: Same as upstream piping unless otherwise indicated.
 - H. Valve Actuator Types:
 - 1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
 - 2. Handwheel: For other than quarter-turn trim and drain valves.
 - 3. Handlever: For quarter-turn trim and drain valves NPS 2 and smaller.
- 2.3 TWO-PIECE BALL VALVES WITH INDICATORS
 - A. Description:
 - 1. UL 1091, except with ball instead of disc and FM Global approved for indicating valves (butterfly or ball type), Class Number 1112.
 - 2. Minimum Pressure Rating: 175 psig.
 - 3. Body Design: Two piece.
 - 4. Body Material: Forged brass or bronze.
 - 5. Port Size: Full or standard.
 - 6. Seats: PTFE.
 - 7. Stem: Bronze or stainless steel.
 - 8. Ball: Chrome-plated brass.
 - 9. Actuator: Worm gear
 - 10. Supervisory Switch: Internal or external.
 - 11. End Connections for Valves NPS 1 through NPS 2: Threaded ends.
 - 12. End Connections for Valves NPS 2-1/2: Grooved ends.
- 2.4 BRONZE BUTTERFLY VALVES WITH INDICATORS
 - A. Description:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 1112.
2. Minimum: Pressure rating: 175 psig.
3. Body Material: Bronze.
4. Seat Material: EPDM.
5. Stem Material: Bronze or stainless steel.
6. Disc: Stainless steel.
7. Actuator: Worm gear.
8. Supervisory Switch: Internal or external.
9. Ends Connections for Valves NPS 1 through NPS 2: Threaded ends.
10. Ends Connections for Valves NPS 2-1/2: Grooved ends.

2.5 IRON BUTTERFLY VALVES WITH INDICATORS

A. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
2. Minimum Pressure Rating: 175 psig.
3. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.
4. Seat Material: EPDM.
5. Stem: Stainless steel.
6. Disc: Ductile iron, nickel plated and EPDM or SBR coated.
7. Actuator: Worm gear.
8. Supervisory Switch: Internal or external.
9. Body Design: Lug or wafer Grooved-end connections.

2.6 CHECK VALVES

A. Description:

1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
2. Minimum Pressure Rating: 175 psig.
3. Type: Single swing check.
4. Body Material: Cast iron, ductile iron, or bronze.
5. Clapper: Bronze, ductile iron, or stainless steel with elastomeric seal.
6. Clapper Seat: Brass, bronze, or stainless steel.
7. Hinge Shaft: Bronze or stainless steel.
8. Hinge Spring: Stainless steel.
9. End Connections: Flanged, grooved, or threaded.

2.7 BRONZE OS&Y GATE VALVES

A. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Bronze or brass.
4. Wedge: One-piece bronze or brass.
5. Wedge Seat: Bronze.
6. Stem: Bronze or brass.
7. Packing: Non-asbestos PTFE.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

8. Supervisory Switch: External.

9. End Connections: Threaded.

2.8 IRON OS&Y GATE VALVES

A. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).

2. Minimum Pressure Rating: 175 psig.

3. Body and Bonnet Material: Cast or ductile iron.

4. Wedge: Cast or ductile iron, or bronze with elastomeric coating.

5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.

6. Stem: Brass or bronze.

7. Packing: Non-asbestos PTFE.

8. Supervisory Switch: External.

9. End Connections: Flanged or Grooved.

2.9 NRS GATE VALVES

A. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).

2. Minimum Pressure Rating: 175 psig.

3. Body and Bonnet Material: Cast or ductile iron.

4. Wedge: Cast or ductile iron with elastomeric coating.

5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.

6. Stem: Brass or bronze.

7. Packing: Non-asbestos PTFE.

8. Supervisory Switch: External.

9. End Connections: Flanged or Grooved.

2.10 INDICATOR POSTS

A. Description:

1. Standard: UL 789 and FM Global standard for indicator posts.

2. Type: Upright.

3. Base Barrel Material: Cast or ductile iron.

4. Extension Barrel: Cast or ductile iron.

5. Cap: Cast or ductile iron.

6. Operation: Wrench.

2.11 TRIM AND DRAIN VALVES

A. Ball Valves:

1. Description:

a. Pressure Rating: 175 psig.

b. Body Design: Two piece.

c. Body Material: Forged brass or bronze.

d. Port size: Full or standard.

e. Seats: PTFE.

f. Stem: Bronze or stainless steel.

g. Ball: Chrome-plated brass.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- h. Actuator: Handlever.
 - i. End Connections for Valves NPS 1 through NPS 2-1/2: Threaded ends.
 - j. End Connections for Valves NPS 1-1/4 and NPS 2-1/2: Grooved ends.
- B. Angle Valves:
- 1. Description:
 - a. Pressure Rating: 175 psig.
 - b. Body Material: Brass or bronze.
 - c. Ends: Threaded.
 - d. Stem: Bronze.
 - e. Disc: Bronze.
 - f. Packing: Asbestos free.
 - g. Handwheel: Malleable iron, bronze, or aluminum.
- C. Globe Valves:
- 1. Description:
 - a. Pressure Rating: 175 psig.
 - b. Body Material: Bronze with integral seat and screw-in bonnet.
 - c. Ends: Threaded.
 - d. Stem: Bronze.
 - e. Disc Holder and Nut: Bronze.
 - f. Disc Seat: Nitrile.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 INSTALLATION, GENERAL

- A. Comply with requirements in the following Sections for specific valve-installation requirements and applications:
 - 1. Section 21 13 13 "Wet-Pipe Sprinkler Systems" for application of valves in wet-pipe, fire-suppression sprinkler systems.
 - 2. Section 21 13 16 "Dry-Pipe Sprinkler Systems" for application of valves in dry-pipe, fire-suppression sprinkler systems.
- B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply, except from fire-department connections. Install permanent identification signs, indicating portion of system controlled by each valve.
- C. Install double-check valve assembly in each fire-protection water-supply connection.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- D. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.
- E. Install valves in horizontal piping with stem at or above the pipe center.
- F. Install valves in position to allow full stem movement.
- G. Install valve tags. Comply with requirements in Section 21 05 53 "Identification for Fire-Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces concealing valves; and the NFPA standard applying to the piping system in which valves are installed. Install permanent identification signs indicating the portion of system controlled by each valve.

END OF SECTION

SECTION 21 05 29 - HANGERS AND SUPPORTS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal hanger-shield inserts.
5. Fastener systems.
6. Equipment supports.

B. Related Requirements:

1. Section 05 50 00 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 21 05 16 "Expansion Fittings and Loops for Fire-Suppression Piping" for pipe guides and anchors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Include design calculations for designing trapeze hangers.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Comply with NFPA 13.
- B. UL Compliance: Comply with UL 203.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Description: Factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.
 2. Galvanized Metallic Coatings: Pregalvanized or hot-dip galvanized.
 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper Pipe and Tube Hangers:
1. Description: Copper-coated-steel, factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.
 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.
- 2.3 TRAPEZE PIPE HANGERS
- A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with NFPA-approved, UL-listed, or FM-approved carbon-steel hanger rods, nuts, saddles, and U-bolts.
- 2.4 METAL FRAMING SYSTEMS
- A. MFMA Manufacturer Metal Framing Systems:
1. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
 2. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
 3. Channels: Continuous slotted carbon-steel channel with inturred lips.
 4. Channel Width: Selected for applicable load criteria.
 5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
 7. Metallic Coating: No coating.
- B. Non-MFMA Manufacturer Metal Framing Systems:
1. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
 2. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
 3. Channels: Continuous slotted carbon-steel channel with inturred lips.
 4. Channel Width: Select for applicable load criteria.
 5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
 7. Metallic Coating: No coating.
- 2.5 THERMAL HANGER-SHIELD INSERTS
- A. Insulation-Insert Material: Water-repellent-treated, ASTM C533, Type I calcium silicate with 100-psi minimum compressive strength.
- B. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- D. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.
- 2.6 FASTENER SYSTEMS
- A. Powder-Actuated Fasteners: NFPA-approved, UL-listed, or FM-approved threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: NFPA-approved, UL-listed, or FM-approved, insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Indoor Applications: Zinc-coated or Stainless steel.
2. Outdoor Applications: Stainless steel.

2.7 EQUIPMENT SUPPORTS

- A. Description: NFPA-approved, UL-listed, or FM-approved, welded, shop- or field-fabricated equipment support, made from structural-carbon-steel shapes.

2.8 MATERIALS

- A. Aluminum: ASTM B221.
- B. Carbon Steel: ASTM A1011/A1011M.
- C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; black and galvanized.
- D. Stainless Steel: ASTM A240/A240M.
- E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout, suitable for interior and exterior applications.
1. Properties: Nonstaining, noncorrosive, and nongaseous.
 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 INSTALLATION OF HANGERS AND SUPPORTS

- A. Metal Pipe-Hanger Installation: Comply with installation requirements of approvals and listings. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
 2. Field fabricate from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal strut systems.
- D. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Install in accordance with approvals and listings.
 2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions. Install in accordance with approvals and listings.
- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- M. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. MSS SP-58, Type 39 Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. MSS SP-58, Type 40 Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
 - 5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 - 6. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.3 INSTALLATION OF EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

- A. Touchup:
 - 1. Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - a. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with NFPA requirements for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use stainless-steel pipe hangers and attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- H. Use thermal hanger-shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Steel Pipe Clamps (MSS Type 4): For suspension of NPS 1/2 to NPS 24 if little or no insulation is required.
 - 3. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 4. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
 - 5. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
 - 6. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

7. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 8. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 9. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Comply with NFPA requirements.
- L. Building Attachments: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. C-Clamps (MSS Type 23): For structural shapes.
 3. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- M. Saddles and Shields: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.
- N. Comply with NFPA requirements for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 21 05 53- IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Stencils.
 - 5. Valve tags.
 - 6. Warning tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.
- D. Valve Schedules: Valve numbering scheme.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: Brass, 0.032 inch, stainless steel, 0.025 inch, aluminum, 0.032 inch or anodized aluminum, 0.032 inch thick, with predrilled holes for attachment hardware.
 - 2. Letter Color: Red.
 - 3. Background Color: White.
 - 4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 6. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
 - 2. Letter Color: Red.
 - 3. Background Color: White.
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

7. Fasteners: Stainless-steel rivets or self-tapping screws.
 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- D. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
- B. Letter Color: Red.
- C. Background Color: White.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction according to ASME A13.1.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 2. Lettering Size: Size letters according to ASME A13.1 for piping.
- E. Pipe-Label Colors:
 1. Background Color: Safety Red.
 2. Letter Color: White.

2.4 STENCILS

- A. Stencils for Piping:
 1. Lettering Size: Size letters according to ASME A13.1 for piping.
 2. Stencil Material: Fiberboard or metal.
 3. Stencil Paint: Safety Red, exterior, gloss, alkyd enamel. Paint may be in pressurized spray-can form.
 4. Identification Paint: White, exterior, alkyd enamel. Paint may be in pressurized spray-can form.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2.5 VALVE TAGS

- A. Description: Stamped or engraved with 1/4-inch letters for piping-system abbreviation and 1/2-inch numbers.
 - 1. Tag Material: Brass, 0.032 inch or anodized aluminum, 0.032 inch thick, with predrilled holes for attachment hardware.
 - 2. Fasteners: Brass wire-link chain or S-hook.
 - 3. Valve-Tag Color: Safety Red.
 - 4. Letter Color: White.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

- A. Stenciled Pipe-Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.
 - 1. Identification Paint: Use for contrasting background.
 - 2. Stencil Paint: Use for pipe marking.
- B. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit a view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes including pipes where flow is allowed in both directions.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in fire-suppression piping systems. List tagged valves in a valve-tag schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:
 - 1. Valve-Tag Size and Shape:
 - a. Wet-Pipe Sprinkler System: 1-1/2 inches.
 - b. Dry-Pipe Sprinkler System: 1-1/2 inches.

END OF SECTION

SECTION 21 13 13 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Cover system for sprinkler piping.
3. Specialty valves.
4. Sprinklers.
5. Alarm devices.
6. Manual control stations.
7. Control panels.
8. Pressure gauges.

B. Related Requirements:

1. Section 21 11 19 "Fire Department Connections" for exposed-, flush-, and yard-type fire department connections.
2. Section 23 05 23 "General-Duty Valves for Water-Based Fire-Suppression Piping" for ball, butterfly, check, gate, post-indicator, and trim and drain valves.

1.3 DEFINITIONS

- A. High-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175 psig, but not higher than 250 psig.
- B. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: For wet-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

D. Delegated-Design Submittal: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems, or BIM model, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved.

B. Qualification Data: For qualified Installer and professional engineer.

C. Design Data:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- D. Welding certificates.
- E. Field Test Reports:
 1. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
 2. Fire-hydrant flow test report.
- F. Field quality-control reports.
- 1.6 CLOSEOUT SUBMITTALS
 - A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.
- 1.7 MAINTENANCE MATERIAL SUBMITTALS
 - A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.
- 1.8 QUALITY ASSURANCE
 - A. Installer Qualifications:
 1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
 - B. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.
- 1.9 FIELD CONDITIONS
 - A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:
 1. Notify Owner no fewer than two days in advance of proposed interruption of sprinkler service.
 2. Do not proceed with interruption of sprinkler service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with NFPA 13.
- C. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- D. High-Pressure Piping System Component: Listed for 250-psig minimum working pressure.
- E. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design wet-pipe sprinkler systems.
 1. Sprinkler system design shall be approved by authorities having jurisdiction.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
- b. Sprinkler Occupancy Hazard Classifications:
 - 1) Automobile Parking Areas: Ordinary Hazard, Group 1.
 - 2) Building Service Areas: Ordinary Hazard, Group 1.
 - 3) Electrical Equipment Rooms: Ordinary Hazard, Group 1.
 - 4) Elevator Machine Room and Hoistway: Ordinary Hazard, Group 1.
 - 5) General Storage Areas: Ordinary Hazard, Group 1.
 - 6) Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
 - 7) Office and Public Areas: Light Hazard.
 - 8) Restaurant Service Areas: Ordinary Hazard, Group 1.
2. Minimum Density for Automatic-Sprinkler Piping Design:
 - a. Residential (Dwelling) Occupancy: 0.05 gpm over 400-sq. ft. area.
 - b. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
 - c. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
 - d. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.
 - e. Extra-Hazard, Group 1 Occupancy: 0.30 gpm over 2500-sq. ft. area.
 - f. Extra-Hazard, Group 2 Occupancy: 0.40 gpm over 2500-sq. ft. area.
 - g. Special Occupancy Hazard: As determined by authorities having jurisdiction.
3. Maximum protection area per sprinkler according to UL listing.
4. Maximum Protection Area per Sprinkler:
 - a. Residential Areas: 400 sq. ft..
 - b. Office Spaces: 120 sq. ft..
 - c. Storage Areas: 130 sq. ft..
 - d. Mechanical Equipment Rooms: 130 sq. ft..
 - e. Electrical Equipment Rooms: 130 sq. ft..
 - f. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.

2.2 STEEL PIPE AND FITTINGS

- A. Standard-Weight, Galvanized- and Black-Steel Pipe: ASTM A53/A53M,.. Pipe ends may be factory or field formed to match joining method.
- B. Schedule 30, Galvanized- and Black-Steel Pipe: ASTM A135/A135M; ASTM A795/A795M, Type E; or ASME B36.10M wrought steel, with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.
- C. Thinwall Galvanized- and Black-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.
- D. Galvanized- and Black-Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M, standard-weight, seamless steel pipe with threaded ends.
- E. Galvanized- and Uncoated-Steel Couplings: ASTM A865/A865M, threaded.
- F. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- G. Malleable- or Ductile-Iron Unions: UL 860.
- H. Cast-Iron Flanges: ASME 16.1, Class 125.
- I. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
 1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or EPDM rubber gasket.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
 - b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.
 2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.
 - J. Steel Welding Fittings: ASTM A234/A234M and ASME B16.9.
 1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
 - K. Grooved-Joint, Steel-Pipe Appurtenances:
 1. Pressure Rating: 175-psig minimum.
 2. Galvanized Grooved-End Fittings for Steel Piping: ASTM A47/A47M, malleable-iron casting or ASTM A536, ductile-iron casting, with dimensions matching steel pipe.
 3. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.
 - L. Steel Pressure-Seal Fittings: UL 213, FM Global-approved, 175-psig pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.
- 2.3 COPPER TUBE AND FITTINGS
- A. Drawn-Temper Copper Tube: ASTM B88, Type K (ASTM B88M, Type A) and ASTM B88, Type M.
 - B. Cast-Copper, Solder-Joint Fittings: ASME B16.18 pressure fittings.
 - C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22 pressure fittings.
 - D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
 - E. Cast Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
 - F. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
 - G. Copper-Tube, Mechanically Formed Tee Fitting: For forming T-branch on copper water tube.
 1. Description: Tee formed in copper tube according to ASTM F2014.
 - H. Grooved, Mechanical-Joint, Copper-Tube Appurtenances:
 1. Standard: UL 213.
 2. Grooved-End Copper Fittings: ASTM B75 copper tube or ASTM B584 bronze castings.
 3. Grooved-End-Tube Couplings: To fit copper tube dimensions; rigid pattern unless otherwise indicated; gasketed fitting EPDM-rubber gasket rated for minimum 180 deg F for use with ferrous housing and steel bolts and nuts; 300 psig minimum CWP pressure rating.
 - I. Copper-Tube, Pressure-Seal-Joint Fittings:
 1. Fittings: Cast-brass, cast-bronze, or wrought-copper with EPDM O-ring seal in each end.
 2. Minimum 200-psig working-pressure rating at 250 deg F.
- 2.4 COVER SYSTEM FOR SPRINKLER PIPING
- A. Description: System of support brackets and covers made to protect sprinkler piping.
 - B. Brackets: Glass-reinforced nylon.
 - C. Covers: Extruded-PVC sections of length, shape, and size required for size and routing of CPVC piping.
- 2.5 SPECIALTY VALVES
- A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
 - B. Pressure Rating:
 1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. High-Pressure Piping Specialty Valves: 250-psig minimum.
 - C. Body Material: Cast or ductile iron.
 - D. Size: Same as connected piping.
 - E. End Connections: Flanged or grooved.
 - F. Alarm Valves:
 1. Standard: UL 193.
 2. Design: For horizontal or vertical installation.
 3. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gauges, retarding chamber, and fill-line attachment with strainer.
 4. Drip cup assembly pipe drain without valves and separate from main drain piping with check valve to main drain piping.
 5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - G. Deluge Valves:
 1. Standard: UL 260.
 2. Design: Hydraulically operated, differential-pressure type.
 3. Include trim sets for alarm-test bypass, drain, electrical water-flow alarm switch, pressure gauges, drip cup assembly piped without valves and separate from main drain line, and fill-line attachment with strainer.
 4. Wet, Pilot-Line Trim Set: Include gauge to read diaphragm-chamber pressure and manual control station for manual operation of deluge valve, and connection for actuation device.
 - H. Automatic (Ball Drip) Drain Valves:
 1. Standard: UL 1726.
 2. Pressure Rating: 175-psig minimum.
 3. Type: Automatic draining, ball check.
 4. Size: NPS 3/4.
 5. End Connections: Threaded.
- 2.6 AIR VENT
- A. Manual Air Vent/Valve:
 1. Description: Ball valve that requires human intervention to vent air.
 2. Body: Forged brass.
 3. Ends: Threaded.
 4. Minimize Size: 1/2 inch.
 5. Minimum Water Working Pressure Rating: 300 psig.
 - B. Automatic Air Vent:
 1. Description: Automatic air vent that automatically vents trapped air without human intervention.
 2. Standard: UL listed or FM Global approved for use in wet-pipe fire sprinkler systems.
 3. Vents oxygen continuously from system.
 4. Float valve to prevent water discharge.
 5. Minimum Water Working Pressure Rating: 175 psig.
 - C. Automatic Air Vent Assembly:
 1. Description: Automatic dual air vent assembly that automatically vents trapped air without human intervention, including Y-strainer and ball valve in a pre-piped assembly.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Standard: UL listed or FM Global approved for use in wet-pipe fire sprinkler system.
3. Vents oxygen continuously from system.
4. Float valve to prevent water discharge.
5. Minimum Water Working Pressure Rating: 175 psig.

2.7 SPRINKLER PIPING SPECIALTIES

A. Branch Outlet Fittings:

1. Standard: UL 213.
2. Pressure Rating: 175-psig minimum.
3. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
4. Type: Mechanical-tee and -cross fittings.
5. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
6. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
7. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:

1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
2. Pressure Rating: 175-psig minimum.
3. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded or grooved.

C. Branch Line Testers:

1. Standard: UL 199.
2. Pressure Rating: 175 psig.
3. Body Material: Brass.
4. Size: Same as connected piping.
5. Inlet: Threaded.
6. Drain Outlet: Threaded and capped.
7. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:

1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
2. Pressure Rating: 175-psig minimum.
3. Body Material: Cast- or ductile-iron housing with sight glass.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded.

E. Adjustable Drop Nipples:

1. Standard: UL 1474.
2. Pressure Rating: 250-psig minimum.
3. Body Material: Steel pipe with EPDM-rubber O-ring seals.
4. Size: Same as connected piping.
5. Length: Adjustable.
6. Inlet and Outlet: Threaded.

F. Flexible Sprinkler Hose Fittings:

1. Standard: UL 1474.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
3. Pressure Rating: 175-psig minimum.
4. Size: Same as connected piping, for sprinkler.

2.8 SPRINKLERS

- A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- B. Pressure Rating for Residential Sprinklers: 175-psig maximum.
- C. Pressure Rating for Automatic Sprinklers: 175-psig minimum.
- D. Pressure Rating for High-Pressure Automatic Sprinklers: 250-psig minimum.
- E. Automatic Sprinklers with Heat-Responsive Element:
 1. Early-Suppression, Fast-Response Applications: UL 1767.
 2. Nonresidential Applications: UL 199.
 3. Residential Applications: UL 1626.
 4. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- F. Open Sprinklers with Heat-Responsive Element Removed: UL 199.
 1. Nominal Orifice:
 - a. 1/2 inch, with discharge coefficient K between 5.3 and 5.8.
 - b. 17/32 inch with discharge coefficient K between 7.4 and 8.2.
- G. Sprinkler Finishes: Chrome plated.
- H. Special Coatings: Wax lead and corrosion-resistant paint.
- I. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
 1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
 2. Sidewall Mounting: Plastic, white finish, one piece, flat.
- J. Sprinkler Guards:
 1. Standard: UL 199.
 2. Type: Wire cage with fastening device for attaching to sprinkler.

2.9 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Water-Motor-Operated Alarm:
 1. Standard: UL 753.
 2. Type: Mechanically operated, with Pelton wheel.
 3. Alarm Gong: Cast aluminum with red-enamel factory finish.
 4. Size: 8-1/2-inches diameter.
 5. Components: Shaft length, bearings, and sleeve to suit wall construction.
 6. Inlet: NPS 3/4.
 7. Outlet: NPS 1 drain connection.
- C. Electrically Operated Notification Appliances:
 1. Electric Bell:
 - a. Standard: UL 464.
 - b. Type: Vibrating, metal alarm bell.
 - c. Size: 6-inch minimum- diameter.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- d. Voltage: 120 V ac, 60 Hz, 1 phase.
 - e. Finish: Red-enamel or polyester powder-coat factory finish, suitable for outdoor use with approved and listed weatherproof backbox.
2. Strobe/Horn:
 - a. Standard: UL 464.
 - b. Tone: Selectable, steady, Temporal-3 (T-3) in accordance with ISO 8201 and ANSI/ASA S3.41, 2400 Hz, electromechanical, broadband.
 - c. Voltage: 120 V ac, 60 Hz.
 - d. Effective Intensity: 110 cd.
 - e. Finish: Red, suitable for outdoor use with approved and listed weatherproof backbox. White letters on housing identifying device as for "Fire."
 - f. Sign, Integrated: Mount between backbox and strobe/horn with text visible on both sides, above and below strobe/horn. Housing to be shaped to cover surface-mounted weatherproof backbox. Sign is to consist of white lettering on red plastic identifying it as a "Sprinkler Fire Alarm" and instructing viewers to call 911, police, or fire department.
- D. Water-Flow Indicators:
1. Standard: UL 346.
 2. Water-Flow Detector: Electrically supervised.
 3. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
 4. Type: Paddle operated.
 5. Pressure Rating: 250 psig.
 6. Design Installation: Horizontal or vertical.
- E. Pressure Switches:
1. Standard: UL 346.
 2. Type: Electrically supervised water-flow switch with retard feature.
 3. Components: Single-pole, double-throw switch with normally closed contacts.
 4. Design Operation: Rising pressure signals water flow.
- F. Valve Supervisory Switches:
1. Standard: UL 346.
 2. Type: Electrically supervised.
 3. Components: Single-pole, double-throw switch with normally closed contacts.
 4. Design: Signals that controlled valve is in other than fully open position.
 5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- 2.10 MANUAL CONTROL STATIONS
- A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide" for hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve.
 - B. Include metal enclosure labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.
- 2.11 CONTROL PANELS
- A. Description: Single-area, two-area, or single-area cross-zoned control panel as indicated, including NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide" when used with thermal detectors and Class A detector circuit wiring.
 2. Electrical characteristics are 120-V ac, 60 Hz, with 24-V dc rechargeable batteries.
 3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Manual Control Stations, Electric Operation: Metal enclosure, labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.
- C. Manual Control Stations, Hydraulic Operation: With union, NPS 1/2 pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.
- D. Panels Components:
1. Power supply.
 2. Battery charger.
 3. Standby batteries.
 4. Field-wiring terminal strip.
 5. Electrically supervised solenoid valves and polarized fire-alarm bell.
 6. Lamp test facility.
 7. Single-pole, double-throw auxiliary alarm contacts.
 8. Rectifier.
- 2.12 PRESSURE GAUGES
- A. Standard: UL 393.
 - B. Dial Size: 3-1/2- to 4-1/2-inch diameter.
 - C. Pressure Gauge Range: 0- to 250-psig minimum.
 - D. Label: Include "WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
- B. Report test results promptly and in writing.

3.2 SERVICE-ENTRANCE PIPING

- A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Section 21 11 00 "Facility Fire-Suppression Water-Service Piping" for exterior piping.
- B. Install shutoff valve, backflow preventer, pressure gauge, drain, and other accessories indicated at connection to water-service piping.
- C. Install shutoff valve, check valve, pressure gauge, and drain at connection to water service.

3.3 WATER-SUPPLY CONNECTIONS

- A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Section 22 11 16 "Domestic Water Piping."
- B. Install shutoff valve, backflow preventer, pressure gauge, drain, and other accessories indicated at connection to water-distribution piping.
- C. Install shutoff valve, check valve, pressure gauge, and drain at connection to water supply.

3.4 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
 2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.
 - C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.
 - D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
 - E. Install unions adjacent to each valve in pipes NPS 2 and smaller.
 - F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
 - G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
 - H. Install sprinkler piping with drains for complete system drainage.
 - I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
 - J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.
 - K. Install alarm devices in piping systems.
 - L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13. In seismic-rated areas, refer to Section 21 05 48 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."
 - M. Install pressure gauges on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gauges with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal, and install where they are not subject to freezing.
 - N. Pressurize and check preaction sprinkler system piping and air-pressure maintenance devices.
 - O. Fill sprinkler system piping with water.
 - P. Install electric heating cables and pipe insulation on sprinkler piping in areas subject to freezing. Comply with requirements for heating cables in Section 21 05 33 "Heat Tracing for Fire-Suppression Piping" and for piping insulation in Section 21 07 00 "Fire-Suppression Systems Insulation."
 - Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 21 05 17 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
 - R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 21 05 17 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
 - S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 21 05 18 "Escutcheons for Fire-Suppression Piping."
- 3.5 JOINT CONSTRUCTION
- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
 - B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
 - C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 - E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
 - F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
 - G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
 - H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.
 - I. Steel-Piping, Pressure-Sealed Joints: Join lightwall and Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
 - J. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
 - 1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
 - K. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
 - L. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
 - M. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Braze Joints" Chapter.
 - N. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
 - O. Copper-Tubing, Pressure-Sealed Joints: Join copper tube and copper pressure-seal fittings with tools recommended by fitting manufacturer.
 - P. Extruded-Tee Connections: Form tee in copper tube according to ASTM F2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
 - Q. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.
 - R. Plastic-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
 - 2. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.
- 3.6 INSTALLATION OF COVER SYSTEM FOR SPRINKLER PIPING
- A. Install cover system, brackets, and cover components for sprinkler piping according to manufacturer's "Installation Manual" and NFPA 13 or NFPA 13R for supports.
- 3.7 VALVE AND SPECIALTIES INSTALLATION
- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:
 - 1. Install valves in vertical position for proper direction of flow, in main supply to system.
 - 2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.
 - 3. Install deluge valves in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gauges, priming chamber attachment, and fill-line attachment.
- E. Air Vent:
 - 1. Provide at least one air vent at high point in each wet-pipe sprinkler system in accordance with NFPA 13 requirements. Connect vent into top of fire sprinkler piping.
 - 2. Provide dielectric union for dissimilar metals, ball valve, and strainer upstream of automatic air vent.
 - 3. Pipe from outlet of air vent to drain.

3.8 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.
- B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
- C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.9 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.10 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - 4. Energize circuits to electrical equipment and devices.
 - 5. Coordinate with fire-alarm tests. Operate as required.
 - 6. Coordinate with fire-pump tests. Operate as required.
 - 7. Verify that equipment hose threads are same as local fire department equipment.
- B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.11 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3.12 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves and pressure-maintenance pumps].

3.13 PIPING SCHEDULE

- A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.
- B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
- C. Copper-tube, extruded-tee connections may be used for tee branches in copper tubing instead of specified copper fittings. Branch-connection joints must be brazed.
- D. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:
 - 1. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 - 2. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - 3. Standard-weight or Schedule 30, black-steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.
 - 4. Standard-weight or Schedule 30, galvanized-steel pipe with plain ends; galvanized, plain-end-pipe fittings; and twist-locked joints.
 - 5. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - 6. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - 7. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 - 8. Thinwall Schedule 10 nonstandard OD, thinwall or hybrid black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - 9. Thinwall Schedule 10 or hybrid black-steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.
 - 10. Thinwall Schedule 10 nonstandard OD, thinwall or hybrid black-steel pipe with plain ends; welding fittings; and welded joints.
 - 11. Type L, hard copper tube with plain ends; cast- or wrought-copper, solder-joint fittings; and brazed joints.
 - 12. Type L, hard copper tube with plain ends; copper pressure-seal fittings; and pressure-sealed joints.
 - 13. NPS 2, Type L, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.
- E. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 4, shall be one of the following:
 - 1. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 - 2. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - 3. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

4. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 5. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 6. Thinwall Schedule 10 nonstandard OD, thinwall or hybrid black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 7. Thinwall Schedule 10 nonstandard OD, thinwall or hybrid black-steel pipe with plain ends; welding fittings; and welded joints.
 8. Type L, hard copper tube with plain ends; cast- or wrought-copper, solder-joint fittings; and brazed joints.
 9. Type L, hard copper tube with plain ends; copper pressure-seal fittings; and pressure-sealed joints.
 10. Type L, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.
- F. Standard-pressure, wet-pipe sprinkler system, NPS 5 and larger, shall be one of the following:
1. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 2. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 3. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 4. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 5. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
 6. Thinwall Schedule 10 or hybrid black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 7. Thinwall Schedule 10 or hybrid black-steel pipe with plain ends; welding fittings; and welded joints.
 8. Type L, hard copper tube with plain ends; cast- or wrought-copper, solder-joint fittings; and brazed joints.
 9. Type L, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.

3.14 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:
1. Rooms without Ceilings: Upright sprinklers.
 2. Rooms with Suspended Ceilings: Concealed sprinklers.
 3. Wall Mounting: Sidewall sprinklers.
 4. Spaces Subject to Freezing: Upright, pendent, dry sprinklers; and sidewall, dry sprinklers as indicated.
 5. Special Applications: Extended-coverage, flow-control, and quick-response sprinklers where indicated Attic sprinklers Combustible concealed space sprinklers.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
 2. Flush Sprinklers: Bright chrome, with painted white escutcheon.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
4. Residential Sprinklers: Dull chrome.
5. Upright Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION

SECTION 22 05 10 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 22.

1.2 SUMMARY

- A. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:
 - 1. Submittals.
 - 2. Coordination drawings.
 - 3. Record documents.
 - 4. Maintenance manuals.
 - 5. Rough-ins.
 - 6. Mechanical installations.
 - 7. Cutting and patching.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 22 Section "BASIC MECHANICAL MATERIALS AND METHODS," for materials and methods common to the remainder of Division 22, plus general related specifications including:
 - a. Access to mechanical installations.

1.3 SUBMITTALS

- A. General: Follow the procedures specified in Division 1 Section "SUBMITTALS."
- B. Increase, by the quantity listed below, the number of mechanical related shop drawings, product data, and samples submitted, to allow for required distribution plus two copies of each submittal required, which will be retained by the Mechanical Consulting Engineer.
 - 1. Shop Drawings - Initial Submittal: 1 additional blue- or black-line prints.
 - 2. Shop Drawings - Final Submittal: 1 additional blue- or black-line prints.
 - 3. Product Data: 1 additional copy of each item.
 - 4. Samples: 1 addition as set.
- C. Additional copies may be required by individual sections of these Specifications.

1.4 RECORD DOCUMENTS

- A. Prepare record documents in accordance with the requirements in Division 1 Section "PROJECT CLOSEOUT." In addition to the requirements specified in Division 1, indicate the following installed conditions:
 - 1. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
 - 2. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
 - 3. Contract Modifications, actual equipment and materials installed.

1.5 MAINTENANCE MANUALS

- A. Prepare maintenance manuals in accordance with Division 1 Section "PROJECT CLOSEOUT." In addition to the requirements specified in Division 1, include the following information for equipment items:
 - 1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
 - 2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
 4. Servicing instructions and lubrication charts and schedules.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.
- 1.7 WARRANTIES
- A. Warranties shall begin at date of final completion. All compressors shall include a minimum of five years warranty. One year warranty for labor, parts, units, etc. is required for all equipment. Additionally, Contractor is responsible for all preventative maintenance and routine service on installed equipment for the one year warranty period in order to maintain all factory/manufacturer warranties.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

3.2 MECHANICAL INSTALLATIONS

- A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:
 1. Coordinate mechanical systems, equipment, and materials installation with other building components.
 2. Verify all dimensions by field measurements.
 3. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 4. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
 5. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
 6. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
 7. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
 8. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
 9. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
 10. Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "ACCESS DOORS" and Division 22 Section "BASIC MECHANICAL MATERIALS AND METHODS."
 11. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.3 CUTTING AND PATCHING

- A. General: Perform cutting and patching in accordance with Division 1 Section "CUTTING AND PATCHING." In addition to the requirements specified in Division 1, the following requirements apply:
 - 1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
- B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
 - 1. Uncover Work to provide for installation of ill-timed Work.
 - 2. Remove and replace defective Work.
 - 3. Remove and replace Work not conforming to requirements of the Contract Documents.
 - 4. Remove samples of installed Work as specified for testing.
 - 5. Install equipment and materials in existing structures.
 - 6. Upon written instructions from the Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.
- C. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by the new Work.
- D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
 - 1. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.
 - 2. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

END OF SECTION

SECTION 22 05 11 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and the Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following basic mechanical materials and methods to complement other Division 22 Sections.
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Concrete equipment base construction requirements.
 - 3. Equipment nameplate data requirements.
 - 4. Labeling and identifying mechanical systems and equipment is specified in Division 22.
 - 5. Nonshrink grout for equipment installations.
 - 6. Field-fabricated metal and wood equipment supports.
 - 7. Installation requirements common to equipment specification Sections.
 - 8. Mechanical demolition.
 - 9. Cutting and patching.
 - 10. Touchup painting and finishing.

1.3 DEFINITIONS

- A. Pipe, pipe fittings, and piping include tube, tube fittings, and tubing.
- B. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
- C. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- D. Exposed Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- E. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- F. Concealed Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.
- B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. When stored inside, do not exceed structural capacity of the floor.
- C. Protect flanges, fittings, and piping specialties from moisture and dirt.

1.5 SEQUENCING AND SCHEDULING

- A. Coordinate mechanical equipment installation with other building components.
- B. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.
- D. Coordinate connection of electrical services.
- E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

- F. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices prior to installing acoustical ceilings and similar concealment.

1.6 WARRANTIES

- A. Warranties shall begin at date of substantial completion. All compressors shall include a minimum of five years warranty. One year warranty for labor, parts, units, etc. is required for all equipment. Additionally, Contractor is responsible for all preventative maintenance and routine service on installed equipment for the one year warranty period in order to maintain all factory/manufacture warranties.

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS

- A. Refer to individual piping system specification Sections for pipe and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

- A. Refer to individual piping system specification Sections in Division 22 for special joining materials not listed below.
- B. Solder Filler Metal: ASTM B 32.
 - 1. Alloy Sn95 or Alloy Sn94: Tin (approximately 95 percent) and silver (approximately 5 percent), having 0.10 percent lead content.
 - 2. Alloy E: Tin (approximately 95 percent) and copper (approximately 5 percent), having 0.10 percent maximum lead content.
 - 3. Alloy HA: Tin-antimony-silver-copper-zinc, having 0.10 percent maximum lead content.
 - 4. Alloy HB: Tin-antimony-silver-copper-nickel, having 0.10 percent maximum lead content.
- C. Brazing Filler Metals: AWS A5.8.
 - 1. BCuP Series: Copper-phosphorus alloys.
 - 2. BAg1: Silver alloy.
- D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- E. Solvent Cements: Manufacturer's standard solvents complying with the following:
 - 1. Chlorinated Poly(Vinyl Chloride) (CPVC): ASTM F 493.
 - 2. Poly(Vinyl Chloride) (PVC): ASTM D 2564.
- F. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.
- G. Couplings: Iron body sleeve assembly, fabricated to match outside diameters of plain-end pressure pipes.
 - 1. Sleeve: ASTM A 126, Class B, gray iron.
 - 2. Followers: ASTM A 47 (ASTM A 47M), Grade 32510 or ASTM A 536 ductile iron.
 - 3. Gaskets: Rubber.
 - 4. Bolts and Nuts: AWWA C111.
 - 5. Finish: Enamel paint.

2.3 IDENTIFYING DEVICES AND LABELS

- A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 22 Sections. Where more than one type is specified for listed application, selection is Installer's option, but provide single selection for each product category.
- B. Equipment Nameplates: Metal nameplate with operational data engraved or stamped, permanently

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

fastened to equipment.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.
 2. Location: An accessible and visible location.
- C. Stencils: Standard stencils, prepared for required applications with letter sizes conforming to recommendations of ASME A13.1 for piping and similar applications, but not less than 1-1/4-inch (30mm) -high letters for ductwork and not less than 3/4-inch (19mm) -high letters for access door signs and similar operational instructions.
1. Material: Brass.
 2. Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.
 3. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ASME A13.1 for colors.
- D. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, lettering, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.

2.4 GROUT

- A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.
1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 2. Design Mix: 5000-psi (34.50MPa), 28-day compressive strength.
 3. Packaging: Premixed and factory-packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS--COMMON REQUIREMENTS

- A. General: Install piping as described below, except where system Sections specify otherwise. Individual piping system specification Sections in Division 22 specify piping installation requirements unique to the piping system.
- B. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, except where deviations to layout are approved on coordination drawings.
- C. Install components having pressure rating equal to or greater than system operating pressure.
- D. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
- E. Install piping free of sags and bends.
- F. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.
- G. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
- H. Install piping to allow application of insulation plus 1-inch (25mm) clearance around insulation.
- I. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
- J. Install fittings for changes in direction and branch connections.
- K. Install couplings according to manufacturer's printed instructions.
- L. Sleeves are not required for core drilled holes.
- M. Permanent sleeves are not required for holes formed by PE plastic (removable) sleeves.
- N. Install sleeves for pipes passing through concrete and masonry walls, concrete floor and roof slabs, and where indicated.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring where specified.
 2. Install large enough sleeves to provide 1/4-inch (6mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than 6 inches (150 mm).
 3. Except for below-grade wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants specified in Division 7 Section "Joint Sealants."
 - O. Above Grade, Exterior Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch (25mm) annular clear space between pipe and sleeve for installation of mechanical seals.
 1. Install steel pipe for sleeves smaller than 6 inches (150 mm).
 2. Install cast-iron wall pipes for sleeves 6 inches (150 mm) and larger.
 3. Assemble and install mechanical seals according to manufacturer's printed instructions.
 - P. Below Grade, Exterior Wall, Pipe Penetrations: Install ductile-iron wall penetration system sleeves according to manufacturer's printed installation instructions.
 - Q. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping sealant material. Firestopping materials are specified in Division 7 Section "Firestopping."
 - R. Verify final equipment locations for roughing in.
 - S. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping system Sections.
 1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 3. Soldered Joints: Construct joints according to AWS "Soldering Manual," Chapter 22 "The Soldering of Pipe and Tube."
 4. Brazed Joints: Construct joints according to AWS "Brazing Manual" in the "Pipe and Tube" chapter.
 5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full inside diameter. Join pipe fittings and valves as follows:
 - a. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
 - b. Apply appropriate tape or thread compound to external pipe threads (except where dry seal threading is specified).
 - c. Align threads at point of assembly.
 - d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
 - e. Damaged Threads: Do not use pipe or pipe fittings having threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
 - T. Piping Connections: Except as otherwise indicated, make piping connections as specified below.
 1. Install unions in piping 2 inches (50 mm) and smaller adjacent to each valve and at final connection to each piece of equipment having a 2-inch (50mm) or smaller threaded pipe connection.
 2. Wet Piping Systems (Water and Steam): Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.
- 3.2 EQUIPMENT INSTALLATION--COMMON REQUIREMENTS
- A. Install equipment to provide the maximum possible headroom where mounting heights are not indicated.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Architect.
- C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.
- D. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
- E. Install equipment giving right-of-way to piping systems installed at a required slope.

3.3 LABELING AND IDENTIFYING

- A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
 - 1. Stenciled Markers: Complying with ASME A13.1.
- B. Equipment: Install engraved plastic laminate sign or equipment marker on or near each major item of mechanical equipment.
 - 1. Lettering Size: Minimum 1/4-inch (6mm) -high lettering for name of unit where viewing distance is less than 2 feet (0.6 m), 1/2-inch (13mm) -high for distances up to 6 feet (1.8 m), and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 to 3/4 of size of principal lettering.
 - 2. Text of Signs: Provide text to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to name of identified unit.
- C. Adjusting: Relocate identifying devices which become visually blocked by work of this Division or other Divisions.

3.4 PAINTING AND FINISHING

- A. Damage and Touch Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 DEMOLITION

- A. Disconnect, demolish, and remove work specified under Division 22 and as indicated.
- B. Where pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.
- C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.
- D. Abandoned Work: Cut and remove buried pipe abandoned in place, 2 inches (50 mm) beyond the face of adjacent construction. Cap and patch surface to match existing finish.
- E. Removal: Remove indicated equipment from the Project site.
- F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.6 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of the trades involved.
- B. Repair cut surfaces to match adjacent surfaces.

3.7 GROUTING

- A. Install nonmetallic nonshrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms for placement of grout, as required.
- D. Avoid air entrapment when placing grout.
- E. Place grout to completely fill equipment bases.
- F. Place grout on concrete bases to provide a smooth bearing surface for equipment.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's printed instructions.

END OF SECTION

SECTION 22 05 13 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Premium efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable-Frequency Controllers:
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
 - 2. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 3. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 22 05 17 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Stack-sleeve fittings.
 - 3. Sleeve-seal systems.
 - 4. Sleeve-seal fittings.
 - 5. Grout.
 - 6. Silicone sealants.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. CALPICO, Inc.
 - 3. GPT; an EnPro Industries company.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop collar.
- C. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, anticorrosion coated or galvanized, with plain ends and integral welded waterstop collar.
- D. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- E. PVC Pipe Sleeves: ASTM D1785, Schedule 40.
- F. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.
- G. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

- A. Description: Manufactured, Dura-coated or Duco-coated galvanized cast-iron sleeve with integral clamping flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

- A. Description:
 - 1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 2. Designed to form a hydrostatic seal of 20 psig minimum.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
4. Pressure Plates: Carbon steel.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B633, Stainless steel of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.
- B. Plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

- A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.6 SILICONE SEALANTS

- A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C920, Type S, Grade NS, Class 25, Use NT.
- B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.
- C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
 2. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 3. Using grout or silicone sealant, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 1. Cut sleeves to length for mounting flush with both surfaces.
 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.
- E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at

pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 07 84 13 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
 - 1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 07 62 00 "Sheet Metal Flashing and Trim."
 - 3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
 - 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 5. Use silicone sealant to seal the space around outside of stack-sleeve fittings.
- B. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping specified in Section 07 84 13 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Use grout or silicone sealant to seal the space around outside of sleeve-seal fittings.

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
- B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.6 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves.
 - b. Piping NPS 6 and Larger: Cast-iron pipe sleeves.
 - 2. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 and Larger: Cast-iron pipe sleeves with sleeve-seal system.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
3. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 and Larger: Cast-iron pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
4. Concrete Slabs above Grade:
 - a. Piping Smaller Than NPS 6: Steel pipe sleeves.
 - b. Piping NPS 6 and Larger: Steel pipe sleeves.
5. Interior Partitions:
 - a. Piping Smaller Than NPS 6: Steel pipe sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel sheet sleeves.

END OF SECTION

SECTION 22 05 18 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.
 - 2. Floor plates.

1.3 DEFINITIONS

- A. Existing Piping to Remain: Existing piping that is not to be removed and that is not otherwise indicated to be removed and salvaged, or removed and reinstalled.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. BrassCraft Manufacturing Co.; a Masco company.
 - 2. Dearborn Brass.
 - 3. Jones Stephens Corp.
 - 4. Keeney Manufacturing Company (The).
 - 5. Mid-America Fittings, Inc.
 - 6. ProFlo; a Ferguson Enterprises, Inc. brand.

2.2 ESCUTCHEONS

- A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Stainless-Steel Type: With polished stainless-steel finish.
- C. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- D. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.
- E. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.
- F. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed and exposed-rivet hinge; and spring-clip fasteners.

2.3 FLOOR PLATES

- A. Split Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
 - b. Chrome-Plated Piping: One-piece steel with polished, chrome-plated finish.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- c. Insulated Piping: One-piece stamped steel or split-plate, stamped steel with concealed hinge or split-plate, stamped steel with exposed-rivet hinge with polished, chrome-plated finish.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge or split-plate, stamped steel with exposed-rivet hinge with polished, chrome-plated finish.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge or split-plate, stamped steel with exposed-rivet hinge with polished, chrome-plated finish.
 - f. Bare Piping in Unfinished Service Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge or split-plate, stamped steel with exposed-rivet hinge with polished, chrome-plated finish.
 - g. Bare Piping in Equipment Rooms: One-piece stamped steel or split-plate, stamped steel with concealed hinge or split-plate, stamped steel with exposed-rivet hinge with polished, chrome-plated finish.
- C. Install floor plates for piping penetrations of equipment-room floors.
 - D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. New Piping: One-piece, floor plate.
 - 2. Existing Piping: Split floor plate.
- 3.2 FIELD QUALITY CONTROL
- A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION

SECTION 22 05 19 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Filled-system thermometers.
3. Liquid-in-glass thermometers.
4. Light-activated thermometers.
5. Thermowells.
6. Dial-type pressure gages.
7. Gage attachments.
8. Test plugs.
9. Test-plug kits.
10. Sight flow indicators.

B. Related Requirements:

1. Section 22 11 13 "Facility Water Distribution Piping" for domestic water meters and combined domestic and fire-protection water-service meters outside the building.
2. Section 22 11 19 "Domestic Water Piping Specialties" for water meters.
3. Section 22 15 13 "General-Service Compressed-Air Piping" for compressed air gages.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of meter and gage.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ashcroft Inc.
2. Nanmac Corporation.
3. Trerice, H. O. Co.
4. WATTS.
5. Weiss Instruments, Inc.
6. WIKA Instrument Corporation.

- B. Standard: ASME B40.200.

- C. Case: Liquid-filled and sealed type(s); stainless steel with 3-inch nominal diameter.

- D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F and deg C.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- E. Connector Type(s): Union joint, adjustable angle rigid, back and rigid, bottom, with unified-inch screw threads.
- F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.
- G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.
- H. Window: Plain glass or plastic.
- I. Ring: Stainless steel.
- J. Element: Bimetal coil.
- K. Pointer: Dark-colored metal.
- L. Accuracy: Plus or minus 1 percent of scale range.

2.2 FILLED-SYSTEM THERMOMETERS

A. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ashcroft Inc.
 - b. Terice, H. O. Co.
 - c. Weiss Instruments, Inc.
- 2. Standard: ASME B40.200.
- 3. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
- 4. Element: Bourdon tube or other type of pressure element.
- 5. Movement: Mechanical, dampening type, with link to pressure element and connection to pointer.
- 6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
- 7. Pointer: Dark-colored metal.
- 8. Window: Glass or plastic.
- 9. Ring: Metal Stainless steel.
- 10. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device rigid, back and rigid, bottom; with ASME B1.1 screw threads.
- 11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
- 12. Accuracy: Plus or minus 1 percent of scale range.

B. Direct-Mounted, Plastic-Case, Vapor-Actuated Thermometers:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ashcroft Inc.
 - b. Miljoco Corporation.
 - c. REOTEMP Instrument Corporation.
- 2. Standard: ASME B40.200.
- 3. Case: Sealed type, plastic; 4-1/2-inch nominal diameter.
- 4. Element: Bourdon tube or other type of pressure element.
- 5. Movement: Mechanical, with link to pressure element and connection to pointer.
- 6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
- 7. Pointer: Dark-colored metal.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

8. Window: Glass or plastic.
 9. Ring: Metal or plastic.
 10. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device rigid, back and rigid, bottom; with ASME B1.1 screw threads.
 11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
 12. Accuracy: Plus or minus 1 percent of scale range.
- C. Remote-Mounted, Metal-Case, Vapor-Actuated Thermometers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ashcroft Inc.
 - b. Terice, H. O. Co.
 - c. Weiss Instruments, Inc.
 - d. WIKA Instrument Corporation.
 2. Standard: ASME B40.200.
 3. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch nominal diameter with back flange and holes for panel mounting.
 4. Element: Bourdon tube or other type of pressure element.
 5. Movement: Mechanical, with link to pressure element and connection to pointer.
 6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
 7. Pointer: Dark-colored metal.
 8. Window: Glass or plastic.
 9. Ring: Metal Stainless steel.
 10. Connector Type(s): Union joint, back; with ASME B1.1 screw threads.
 11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
 12. Accuracy: Plus or minus 1 percent of scale range.
- 2.3 LIQUID-IN-GLASS THERMOMETERS
- A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:
1. Standard: ASME B40.200.
 2. Case: Cast aluminum; 6-inch nominal size.
 3. Case Form: Back angle unless otherwise indicated.
 4. Tube: Glass with magnifying lens and blue or red organic liquid.
 5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
 6. Window: Glass or plastic.
 7. Stem: Aluminum or brass and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
 8. Connector: 3/4 inch, with ASME B1.1 screw threads.
 9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
- B. Plastic-Case, Compact-Style, Liquid-in-Glass Thermometers:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. WATTS.
 - b. Weiss Instruments, Inc.
 - c. Weksler Glass Thermometer Corp.
 - d. WIKA Instrument Corporation.
 2. Standard: ASME B40.200.
 3. Case: Plastic; 6-inch nominal size.
 4. Case Form: Back angle unless otherwise indicated.
 5. Tube: Glass with magnifying lens and blue or red organic liquid.
 6. Tube Background: Nonreflective with permanently etched scale markings graduated in deg F and deg C.
 7. Window: Glass or plastic.
 8. Stem: Aluminum or brass and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
 9. Connector: 3/4 inch, with ASME B1.1 screw threads.
 10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
- C. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
1. Standard: ASME B40.200.
 2. Case: Cast aluminum; 7-inch nominal size unless otherwise indicated.
 3. Case Form: Adjustable angle Straight unless otherwise indicated.
 4. Tube: Glass with magnifying lens and blue or red organic liquid.
 5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
 6. Window: Glass or plastic.
 7. Stem: Aluminum and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
 8. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
 9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
- D. Plastic-Case, Industrial-Style, Liquid-in-Glass Thermometers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Marsh Bellofram.
 - b. WATTS.
 - c. Weiss Instruments, Inc.
 - d. Weksler Glass Thermometer Corp.
 - e. WIKA Instrument Corporation.
 2. Standard: ASME B40.200.
 3. Case: Plastic; 7-inch nominal size unless otherwise indicated.
 4. Case Form: Adjustable angle unless otherwise indicated.
 5. Tube: Glass with magnifying lens and blue or red organic liquid.
 6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
 7. Window: Glass or plastic.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

8. Stem: Aluminum] Aluminum, brass, or stainless steel and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.4 LIGHT-ACTIVATED THERMOMETERS

2.5 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.6 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ametek U.S. Gauge.
 - b. Trerice, H. O. Co.
 - c. WATTS.
 - d. Weiss Instruments, Inc.
 - e. Weksler Glass Thermometer Corp.
 - f. WIKA Instrument Corporation.
2. Standard: ASME B40.100.
3. Case: Liquid-filled Sealed Open-front, pressure relief type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass or plastic.
10. Ring: Metal Stainless steel.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2.7 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston porous-metal-type surge-dampening device. Include extension for use on insulated piping.
- B. Valves: Brass ball, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.8 TEST PLUGS

- A. Description: Test-station fitting made for insertion into piping tee fitting.
- B. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- C. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.
- D. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
- E. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.9 TEST-PLUG KITS

- A. Furnish one test-plug kit(s) containing one] thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.
- B. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch-diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.
- C. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch-diameter dial and probe. Dial range shall be at least 0 to 200 psig.
- D. Carrying Case: Metal or plastic, with formed instrument padding.

2.10 SIGHT FLOW INDICATORS

- A. Description: Piping inline-installation device for visual verification of flow.
- B. Construction: Bronze or stainless-steel body, with sight glass and ball, flapper, or paddle wheel indicator, and threaded or flanged ends.
- C. Minimum Pressure Rating: 150 psig.
- D. Minimum Temperature Rating: 200 deg F.
- E. End Connections for NPS 2 and Smaller: Threaded.
- F. End Connections for NPS 2-1/2 and Larger: Flanged.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install thermowells with socket extending one-third of pipe diameter to center of pipe and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
- G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- H. Install remote-mounted pressure gages on panel.
- I. Install valve and snubber in piping for each pressure gage for fluids.
- J. Install test plugs in piping tees.
- K. Install thermometers in the following locations:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Inlet and outlet of each water heater.
 2. Inlets and outlets of each domestic water heat exchanger.
 3. Inlet and outlet of each domestic hot-water storage tank.
 4. Inlet and outlet of each remote domestic water chiller.
 5. .
- L. Install pressure gages in the following locations:
1. Building water service entrance into building.
 2. Inlet and outlet of each pressure-reducing valve.
 3. Suction and discharge of each domestic water pump.
- 3.2 CONNECTIONS
- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.
- 3.3 ADJUSTING
- A. Adjust faces of meters and gages to proper angle for best visibility.
- 3.4 THERMOMETER SCALE-RANGE SCHEDULE
- A. Scale Range for Domestic Cold-Water Piping: 0 to 150 deg F and minus 20 to plus 70 deg C.
- B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F and 0 to 150 deg C.

END OF SECTION

SECTION 22 05 23.12 - BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Brass ball valves.
 - 2. Bronze ball valves.
 - 3. Steel ball valves.
 - 4. Iron ball valves.
 - 5. CPVC ball valves.
 - 6. PVC ball valves.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve.
 - 1. Certification that products comply with NSF 61 and NSF 372.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, and soldered ends.
 - 3. Set ball valves open to minimize exposure of functional surfaces.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B1.20.1 for threads for threaded end valves.
 - 2. ASME B16.1 for flanges on iron valves.
 - 3. ASME B16.5 for flanges on steel valves.
 - 4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 5. ASME B16.18 for solder-joint connections.
 - 6. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 and NSF 372 for valve materials for potable-water service.
- D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
 - F. Valve Sizes: Same as upstream piping unless otherwise indicated.
 - G. Valve Actuator Types:
 - 1. Gear Actuator: For quarter-turn valves NPS 4 and larger.
 - 2. Handlever: For quarter-turn valves smaller than NPS 4.
 - H. Valves in Insulated Piping:
 - 1. Include 2-inch stem extensions.
 - 2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
 - 3. Memory stops that are fully adjustable after insulation is applied.
- 2.2 BRASS BALL VALVES
- A. Brass Ball Valves, One-Piece:
 - 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 400 psig.
 - c. Body Design: One piece.
 - d. Body Material: Forged brass or bronze.
 - e. Ends: Threaded and soldered.
 - f. Seats: PTFE.
 - g. Stem: Brass or stainless steel.
 - h. Ball: Chrome-plated brass or stainless steel.
 - i. Port: Reduced.
 - B. Brass Ball Valves, Two-Piece with Full Port and Brass Trim, Threaded or Soldered Ends:
 - 1. Description:
 - a. Standard: MSS SP-110 or MSS SP-145.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Forged brass.
 - e. Ends: Threaded and soldered.
 - f. Seats: PTFE.
 - g. Stem: Brass.
 - h. Ball: Chrome-plated brass.
 - i. Port: Full.
 - C. Brass Ball Valves, Two-Piece with Full Port and Brass Trim, Press Ends:
 - 1. Description:
 - a. Standard: MSS SP-110 or MSS SP-145.
 - b. CWP Rating: Minimum 200 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Forged brass.
 - e. Ends: Press.
 - f. Press Ends Connections Rating: Minimum 200 psig.
 - g. Seats: PTFE or RPTFE.
 - h. Stem: Brass.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- i. Ball: Chrome-plated brass.
 - j. Port: Full.
 - k. O-Ring Seal: Buna-N or EPDM.
- D. Brass Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim, Threaded or Soldered Ends:
 - 1. Description:
 - a. Standard: MSS SP-110 or MSS SP-145.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Forged brass.
 - e. Ends: Threaded and soldered.
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel, vented.
 - i. Port: Full.
- E. Brass Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim, Press Ends:
 - 1. Description:
 - a. Standard: MSS SP-110 or MSS SP-145.
 - b. CWP Rating: Minimum 200 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Forged brass.
 - e. Ends: Press.
 - f. Press Ends Connections Rating: Minimum 200 psig.
 - g. Seats: PTFE or RPTFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Full.
 - k. O-Ring Seal: Buna-N or EPDM.
- F. Brass Ball Valves, Two-Piece with Regular Port and Brass Trim:
 - 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Forged brass.
 - e. Ends: Threaded and soldered.
 - f. Seats: PTFE.
 - g. Stem: Brass.
 - h. Ball: Chrome-plated brass.
 - i. Port: Regular.
- G. Brass Ball Valves, Two-Piece with Regular Port and Stainless-Steel Trim:
 - 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- d. Body Material: Brass or bronze.
 - e. Ends: Threaded and soldered.
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel, vented.
 - i. Port: Regular.
- H. Brass Ball Valves, Three-Piece with Full Port and Brass Trim:
- 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Three piece.
 - d. Body Material: Forged brass.
 - e. Ends: Threaded and soldered.
 - f. Seats: PTFE.
 - g. Stem: Brass.
 - h. Ball: Chrome-plated brass.
 - i. Port: Full.
- I. Brass Ball Valves, Three-Piece with Full Port and Stainless-Steel Trim:
- 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Three piece.
 - d. Body Material: Forged brass.
 - e. Ends: Threaded and soldered.
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel, vented.
 - i. Port: Full.
- 2.3 BRONZE BALL VALVES
- A. Bronze Ball Valves, One-Piece with Bronze Trim:
- 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 400 psig.
 - c. Body Design: One piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded.
 - f. Seats: PTFE.
 - g. Stem: Bronze.
 - h. Ball: Chrome-plated brass.
 - i. Port: Reduced.
- B. Bronze Ball Valves, One-Piece with Stainless-Steel Trim:
- 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- c. Body Design: One piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded.
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel, vented.
 - i. Port: Reduced.
- C. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim, Threaded or Soldered Ends:
- 1. Description:
 - a. Standard: MSS SP-110 or MSS-145.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded and soldered.
 - f. Seats: PTFE.
 - g. Stem: Bronze or brass.
 - h. Ball: Chrome-plated brass.
 - i. Port: Full.
- D. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim, Press Ends:
- 1. Description:
 - a. Standard: MSS SP-110 or MSS-145.
 - b. CWP Rating: Minimum 200 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Bronze.
 - e. Ends: Press.
 - f. Press Ends Connections Rating: Minimum 200 psig.
 - g. Seats: PTFE or RTPFE.
 - h. Stem: Bronze or brass.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.
 - k. O-Ring Seal: EPDM or Buna-N.
- E. Bronze Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim:
- 1. Description:
 - a. Standard: MSS SP-110 or MSS-145.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded or soldered.
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel, vented.
 - i. Port: Full.
- F. Bronze Ball Valves, Two-Piece with Regular Port and Bronze or Brass Trim:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded.
 - f. Seats: PTFE.
 - g. Stem: Bronze or brass.
 - h. Ball: Chrome-plated brass.
 - i. Port: Regular.
- G. Bronze Ball Valves, Two-Piece with Regular Port and Stainless-Steel Trim:
 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded.
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel, vented.
 - i. Port: Regular.
- H. Bronze Ball Valves, Three-Piece with Full Port and Bronze or Brass Trim:
 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Three piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded.
 - f. Seats: PTFE.
 - g. Stem: Bronze or brass.
 - h. Ball: Chrome-plated brass.
 - i. Port: Full.
- I. Bronze Ball Valves, Three-Piece with Full Port and Stainless-Steel Trim:
 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Three piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded.
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel, vented.
 - i. Port: Full.
- J. Bronze Ball Valves, Three-Piece with Regular Port and Bronze Trim:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Three piece
 - d. Body Material: Bronze
 - e. Ends: Threaded or soldered.
 - f. Seats: PTFE.
 - g. Stem: Bronze.
 - h. Ball: Chrome-plated brass.
 - i. Port: Regular.
 - K. Bronze Ball Valves, Three-Piece with Regular Port and Stainless-Steel Trim:
 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Three piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded or soldered.
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel, vented.
 - i. Port: Regular.
 - L. Bronze Ball Valves, Two-Piece, Safety-Exhaust:
 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Bronze, ASTM B584, Alloy C844.
 - e. Ends: Threaded.
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Chrome-plated brass, with exhaust vent opening for pneumatic applications.
 - i. Port: Full.
- 2.4 STEEL BALL VALVES
- A. Steel Ball Valves with Full Port, Class 150:
 1. Description:
 - a. Standard: MSS SP-72.
 - b. CWP Rating: 285 psig.
 - c. Body Design: Split body.
 - d. Body Material: Carbon steel, ASTM A216, Type WCB.
 - e. Ends: Flanged or threaded.
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel, vented.
 - i. Port: Full.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

B. Steel Ball Valves with Regular Port, Class 150:

1. Description:
 - a. Standard: MSS SP-72.
 - b. CWP Rating: 285 psig.
 - c. Body Design: Uni-body.
 - d. Body Material: Carbon steel, ASTM A216, Type WCB.
 - e. Ends: Flanged or threaded.
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel, vented.
 - i. Port: Regular.

2.5 IRON BALL VALVES

A. Iron Ball Valves, Class 125:

1. Description:
 - a. Standard: MSS SP-72.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Split body.
 - d. Body Material: ASTM A126, gray iron.
 - e. Ends: Flanged or threaded.
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel.
 - i. Port: Full.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install valve tags. Comply with requirements in Section 22 05 53 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
- B. Select valves with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option or press-end option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
 - 4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
 - 5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.4 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG OR LESS)

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Brass ball valves, one piece.
 - 3. Bronze ball valves, one piece with bronze trim.
 - 4. Brass ball valves, two-piece with full port and stainless steel trim.
 - 5. Bronze ball valves, two-piece with full port and stainless steel trim.
 - 6. Brass ball valves, three-piece with full port and stainless steel trim.
 - 7. Bronze ball valve, three-piece with full port and bronze or brass trim.
 - 8. Bronze ball valves, two-piece with regular port and bronze trim.
- B. Pipe NPS 2-1/2 and Larger:
 - 1. Steel and Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
 - 2. Steel ball valves, Class 150 with full port.
 - 3. Iron ball valves, Class 150.

3.5 HIGH-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 TO 200 PSIG)

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Brass ball valve.
 - 3. Bronze ball valve, one piece with stainless steel trim.
 - 4. Brass ball valves, two-piece with full port and stainless steel trim.
 - 5. Bronze ball valves, two-piece with full port and stainless steel trim.
 - 6. Brass ball valves, three-piece with full port and stainless steel trim.
 - 7. Bronze ball valves, three-piece with full port and stainless steel trim.
 - 8. Bronze ball valves, two-piece with regular port and stainless steel trim.
- B. Pipe NPS 2-1/2 and Larger:
 - 1. Steel and Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
 - 2. Steel ball valves, Class 150 with full port.
 - 3. Iron ball valves, Class 150.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3.6 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Brass ball valve, one piece. Provide with threaded or solder-joint ends.
2. Bronze ball valve, one piece with bronze trim. Provide with threaded or solder-joint ends.
3. Brass ball valves, two-piece with full port and stainless steel trim. Provide with threaded, solder or press connection-joint ends.
4. Bronze ball valves, two-piece with full port and stainless steel trim. Provide with threaded, solder or press connection-joint ends.
5. Brass ball valves, three-piece with full port and stainless steel trim.
6. Bronze ball valves, three-piece with full port and stainless steel trim.
7. Bronze ball valves, two-piece with regular port and stainless-steel trim.

B. Pipe NPS 2-1/2 and Larger:

1. Steel and Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Steel ball valves, Class 150 with full port.
3. Iron ball valves, Class 150.

END OF SECTION

SECTION 22 05 23.14 - CHECK VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Bronze lift check valves.
 - 2. Bronze swing check valves.
 - 3. Bronze swing check valves, press ends.
 - 4. Iron swing check valves.
 - 5. Iron swing check valves with closure control.
 - 6. Iron, grooved-end swing check valves.
 - 7. Iron, center-guided check valves.
 - 8. Iron, plate-type check valves.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene-diene terpolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve.
 - 1. Certification that products comply with NSF 61 and NSF 372.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set check valves in either closed or open position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B1.20.1 for threads for threaded end valves.
 - 2. ASME B16.1 for flanges on iron valves.
 - 3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 4. ASME B16.18 for solder joint.
 - 5. ASME B31.9 for building services piping valves.
- C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- D. Drinking Water System Components - Health Effects and Drinking Water System Components - Lead Content Compliance: NSF 61 and NSF 372.
 - E. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
 - F. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
 - G. Valve Sizes: Same as upstream piping unless otherwise indicated.
 - H. Valve Bypass and Drain Connections: MSS SP-45.
- 2.2 BRONZE LIFT CHECK VALVES
- A. Bronze Lift Check Valves with Bronze Disc, Class 125:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Vertical flow.
 - d. Body Material: ASTM B61 or ASTM B62, bronze.
 - e. Ends: Threaded or soldered. See valve schedule articles.
 - f. Disc: Bronze.
 - B. Bronze Lift Check Valves with Nonmetallic Disc, Class 125:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Vertical flow.
 - d. Body Material: ASTM B61 or ASTM B62, bronze.
 - e. Ends: Threaded or soldered. See valve schedule articles.
 - f. Disc: NBR, PTFE.
- 2.3 BRONZE SWING CHECK VALVES
- A. Bronze Swing Check Valves with Bronze Disc, Class 125:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B62, bronze.
 - e. Ends: Threaded or soldered. See valve schedule articles.
 - f. Disc: Bronze.
 - B. Bronze Swing Check Valves with Nonmetallic Disc, Class 125:
 - 1. Description:
 - a. Standard: MSS SP-80, Type 4.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B62, bronze.
 - e. Ends: Threaded or soldered. See valve schedule articles.
 - f. Disc: PTFE.
 - C. Bronze Swing Check Valves with Bronze Disc, Class 150:
 - 1. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 300 psig.
 - c. Body Design: Horizontal flow.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- d. Body Material: ASTM B62, bronze.
 - e. Ends: Threaded or soldered. See valve schedule articles.
 - f. Disc: Bronze.
 - D. Bronze Swing Check Valves with Nonmetallic Disc, Class 150:
 - 1. Description:
 - a. Standard: MSS SP-80, Type 4.
 - b. CWP Rating: 300 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B62, bronze.
 - e. Ends: Threaded or soldered. See valve schedule articles.
 - f. Disc: PTFE.
 - E. Bronze Swing Check Valves, Press Ends:
 - 1. Description:
 - a. Standard: MSS SP-80 and MSS SP-139.
 - b. CWP Rating: Minimum 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B584, bronze.
 - e. Ends: Press.
 - f. Press Ends Connection Rating: Minimum 200 psig
 - g. Disc: Brass or bronze.
- 2.4 IRON SWING CHECK VALVES
 - A. Iron Swing Check Valves with Metal Seats, Class 125:
 - 1. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A126, gray iron with bolted bonnet.
 - e. Ends: Flanged or threaded. See valve schedule articles.
 - f. Trim: Bronze.
 - g. Gasket: Asbestos free.
 - B. Iron Swing Check Valves with Nonmetallic-to-Metal Seats, Class 125:
 - 1. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A126, gray iron with bolted bonnet.
 - e. Ends: Flanged or threaded. See valve schedule articles.
 - f. Trim: Composition.
 - g. Seat Ring: Bronze.
 - h. Disc Holder: Bronze.
 - i. Disc: PTFE.
 - j. Gasket: Asbestos free.
 - C. Iron Swing Check Valves with Metal Seats, Class 250:
 - 1. Description:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Standard: MSS SP-71, Type I.
- b. CWP Rating: 500 psig.
- c. Body Design: Clear or full waterway.
- d. Body Material: ASTM A126, gray iron with bolted bonnet.
- e. Ends: Flanged or threaded. See valve schedule articles.
- f. Trim: Bronze.
- g. Gasket: Asbestos free.

2.5 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Iron Swing Check Valves with Lever- and Spring-Closure Control, Class 125:

1. Description:

- a. Standard: MSS SP-71, Type I.
- b. CWP Rating: 200 psig.
- c. Body Design: Clear or full waterway.
- d. Body Material: ASTM A126, gray iron with bolted bonnet.
- e. Ends: Flanged or threaded. See valve schedule articles.
- f. Trim: Bronze.
- g. Gasket: Asbestos free.
- h. Closure Control: Factory-installed exterior lever and weight.

B. Iron Swing Check Valves with Lever and Weight-Closure Control, Class 125:

1. Description:

- a. Standard: MSS SP-71, Type I.
- b. CWP Rating: 200 psig.
- c. Body Design: Clear or full waterway.
- d. Body Material: ASTM A126, gray iron with bolted bonnet.
- e. Ends: Flanged or threaded. See valve schedule articles.
- f. Trim: Bronze.
- g. Gasket: Asbestos free.
- h. Closure Control: Factory-installed exterior lever and weight.

2.6 IRON, GROOVED-END SWING CHECK VALVES

A. Iron, Grooved-End Swing Check Valves, 300 CWP:

1. Description:

- a. CWP Rating: 300 psig.
- b. Body Material: ASTM A536, ductile iron.
- c. Seal: EPDM.
- d. Disc: Spring operated, ductile iron or stainless steel.

2.7 IRON, CENTER-GUIDED, SPRING-LOADED CHECK VALVES

A. Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat, Class 125:

1. Description:

- a. Standard: MSS SP-125.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM A126, gray iron.
- d. Style: Compact wafer, spring loaded.
- e. Seat: Bronze.

B. Iron Globe, Center-Guided Check Valves with Metal Seat, Class 125:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A126, gray iron.
 - d. Style: Globe, spring loaded.
 - e. Ends: Flanged.
 - f. Seat: Bronze.
- C. Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat, Class 150:
 1. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 300 psig.
 - c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
 - d. Style: Compact wafer, spring loaded.
 - e. Seat: Bronze.
- D. Iron Globe, Center-Guided Check Valves with Metal Seat, Class 150:
 1. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 300 psig.
 - c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
 - d. Style: Globe, spring loaded.
 - e. Ends: Flanged.
 - f. Seat: Bronze.
- E. Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat, Class 250:
 1. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 400 psig.
 - c. Body Material: ASTM A126, gray iron.
 - d. Style: Compact wafer, spring loaded.
 - e. Seat: Bronze.
- F. Iron Globe, Center-Guided Check Valves with Metal Seat, Class 250:
 1. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 400 psig.
 - c. Body Material: ASTM A126, gray iron.
 - d. Style: Globe, spring loaded.
 - e. Ends: Flanged.
 - f. Seat: Bronze.
- G. Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat, Class 300:
 1. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 500 psig.
 - c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
 - d. Style: Compact wafer, spring loaded.
 - e. Seat: Bronze.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- H. Iron Globe, Center-Guided Check Valves with Metal Seat, Class 300:
 - 1. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 500 psig.
 - c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
 - d. Style: Globe, spring loaded.
 - e. Ends: Flanged.
 - f. Seat: Bronze.
- I. Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat, Class 125:
 - 1. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A126, gray iron.
 - d. Style: Compact wafer, spring loaded.
 - e. Seat: EPDM or NBR.
- J. Iron Globe, Center-Guided Check Valves with Resilient Seat, Class 125:
 - 1. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A126, gray iron.
 - d. Style: Globe, spring loaded.
 - e. Ends: Flanged.
 - f. Seat: EPDM or NBR.
- K. Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat, Class 150:
 - 1. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 300 psig.
 - c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
 - d. Style: Compact wafer, spring loaded.
 - e. Seat: EPDM or NBR.
- L. Iron, Globe, Center-Guided Check Valves with Resilient Seat, Class 150:
 - 1. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 300 psig.
 - c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
 - d. Style: Globe, spring loaded.
 - e. Ends: Flanged.
 - f. Seat: EPDM or NBR.
- M. Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat, Class 250:
 - 1. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 400 psig.
 - c. Body Material: ASTM A126, gray iron.
 - d. Style: Compact wafer, spring loaded.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- e. Seat: EPDM or NBR.
- N. Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat, Class 300:
 - 1. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 500 psig.
 - c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
 - d. Style: Compact wafer, spring loaded.
 - e. Seat: EPDM or NBR.
- O. Iron Globe, Center-Guided Check Valves with Resilient Seat, Class 300:
 - 1. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 500 psig.
 - c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
 - d. Style: Globe, spring loaded.
 - e. Ends: Flanged.
 - f. Seat: EPDM or NBR.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Check Valves: Install check valves for proper direction of flow.
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Center-Guided Check Valves: In horizontal or vertical position, between flanges.
 - 3. Lift Check Valves: With stem upright and plumb.
- F. Install valve tags. Comply with requirements in Section 22 05 53 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
 - b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or spring; or iron, center-guided, metal-seat or resilient-seat check valves.
 - c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
 - B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
 - C. End Connections:
 1. For Copper Tubing, NPS 2 and Smaller: Threaded or soldered or press-ends.
 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged or threaded.
 3. For Copper Tubing, NPS 5 and Larger: Flanged.
 4. For Steel Piping, NPS 2 and Smaller: Threaded.
 5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged or threaded.
 6. For Steel Piping, NPS 5 and Larger: Flanged.
 7. For Grooved-End Copper Tubing and Steel Piping: Grooved.
- 3.5 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG OR LESS)
- A. Pipe NPS 2 and Smaller:
 1. Vertical, Upflow Applications Only: Bronze lift check valves with bronze nonmetallic disc, Class 125, with soldered or threaded end connections.
 2. Horizontal and Vertical Applications: Bronze swing check valves with bronze nonmetallic disc, Class 150, with soldered or threaded end connections.
 - B. Pipe NPS 2-1/2 and Larger:
 1. Iron swing check valves with metal seats, Class 125, with threaded or flanged end connections.
 2. Iron, grooved-end swing check valves, 300 CWP.
 3. Iron, dual-plate check valves with metal resilient seat, Class 125, with threaded or flanged end connections.
 4. Iron, single-plate check valves with resilient seat, Class 125, with threaded or flanged end connections.
- 3.6 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE
- A. Pipe NPS 2 and Smaller:
 1. Bronze swing check valves with bronze disc, Class 125, with soldered or threaded end connections.
 - B. Pipe NPS 2-1/2 and Larger:
 1. Iron swing check valves with nonmetallic-to-metal seats, Class 250, with threaded or flanged end connections.
 2. Iron, grooved-end swing check valves, 300 CWP.

END OF SECTION

SECTION 22 05 23.15 - GATE VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Bronze gate valves.
 - 2. Iron gate valves.
 - 3. CPVC gate valves.
 - 4. PVC gate valves.
 - 5. Chainwheels.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. NRS: Nonrising stem.
- C. OS&Y: Outside screw and yoke.
- D. RS: Rising stem.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve.
 - 1. Certification that products comply with NSF 61 and NSF 372.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set gate valves closed to prevent rattling.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B1.20.1 for threads for threaded end valves.
 - 2. ASME B16.1 for flanges on iron valves.
 - 3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 4. ASME B16.18 for solder joint.
 - 5. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 and NSF 372 for valve materials for potable-water service.
- D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. RS Valves in Insulated Piping: With 2-inch stem extensions.
- H. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE GATE VALVES

A. Bronze Gate Valves, NRS, Class 125:

1. Description:

- a. Standard: MSS SP-80, Type 1.
- b. CWP Rating: 200 psig.
- c. Body Material: Bronze with integral seat and screw-in bonnet.
- d. Ends: Threaded or solder joint.
- e. Stem: Bronze.
- f. Disc: Solid wedge; bronze.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron, bronze, or aluminum.

B. Bronze Gate Valves, RS, Class 125:

1. Description:

- a. Standard: MSS SP-80, Type 2.
- b. CWP Rating: 200 psig.
- c. Body Material: Bronze with integral seat and screw-in bonnet.
- d. Ends: Threaded or solder joint.
- e. Stem: Bronze.
- f. Disc: Solid wedge; bronze.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron, bronze, or aluminum.

C. Bronze Gate Valves, NRS, Class 150:

1. Description:

- a. Standard: MSS SP-80, Type 1.
- b. CWP Rating: 300 psig.
- c. Body Material: Bronze with integral seat and union-ring bonnet.
- d. Ends: Threaded.
- e. Stem: Bronze.
- f. Disc: Solid wedge; bronze.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron, bronze, or aluminum.

D. Bronze Gate Valves, RS, Class 150:

1. Description:

- a. Standard: MSS SP-80, Type 2.
- b. CWP Rating: 300 psig.
- c. Body Material: Bronze with integral seat and union-ring bonnet.
- d. Ends: Threaded.
- e. Stem: Bronze.
- f. Disc: Solid wedge; bronze.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron, bronze, or aluminum.
- E. Bronze Gate Valves, Press Ends:
- 1. Description:
 - a. Standard: MSS SP-80 and MSS SP-139.
 - b. CWP Rating: Minimum 200 psig.
 - c. Body Material: Bronze with integral seat and union-ring bonnet.
 - d. Ends: Press.
 - e. Press Ends Connection Rating: Minimum 200 psig.
 - f. Stem: Brass or bronze rising.
 - g. Disc: Solid wedge; bronze.
 - h. Packing: Graphite.
 - i. Port: Full.
 - j. Handwheel: Malleable iron, bronze, or aluminum.

2.3 IRON GATE VALVES

- A. Iron Gate Valves, NRS, Class 150:
- 1. Description:
 - a. Standard: MSS SP-70, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Material: Gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Disc: Solid wedge.
 - g. Packing and Gasket: Asbestos free.
- B. Iron Gate Valves, OS&Y, Class 125:
- 1. Description:
 - a. Standard: MSS SP-70, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Material: Gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Disc: Solid wedge.
 - g. Packing and Gasket: Asbestos free.
- C. Iron Gate Valves, NRS, Class 250:
- 1. Description:
 - a. Standard: MSS SP-70, Type I.
 - b. CWP Rating: 500 psig.
 - c. Body Material: Gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Disc: Solid wedge.
 - g. Packing and Gasket: Asbestos free.
- D. Iron Gate Valves, OS&Y, Class 250:
- 1. Description:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Standard: MSS SP-70, Type I.
- b. CWP Rating: 500 psig.
- c. Body Material: Gray iron with bolted bonnet.
- d. Ends: Flanged.
- e. Trim: Bronze.
- f. Disc: Solid wedge.
- g. Packing and Gasket: Asbestos free.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install chainwheels on operators for gate valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.
- F. Install valve tags. Comply with requirements in Section 22 05 53 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. Use gate valves for shutoff service only.
- B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
- C. For Grooved-End Copper Tubing and Steel Piping: Valve ends may be grooved.

3.5 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG OR LESS)

- A. Pipe NPS 2 and Smaller: Bronze gate valves, NRS, Class 150 with threaded ends.
- B. Pipe NPS 2-1/2 and Larger: Iron gate valves, NRS, Class 150 with flanged ends.

3.6 HIGH-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 TO 200 PSIG)

- A. Pipe NPS 2 and Smaller: Bronze gate valves NRS, Class 150 with threaded ends.
- B. Pipe NPS 2-1/2 and Larger: Iron gate valves, NRS, Class 250 with flanged ends.

3.7 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 1. Bronze gate valves, NRS, Class 150 with threaded ends.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Bronze gate valves, press ends.
- B. Pipe NPS 2-1/2 and Larger: Iron gate valves, NRS , Class 125 with flanged ends.

END OF SECTION

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Fiberglass pipe hangers.
 - 4. Metal framing systems.
 - 5. Fiberglass strut systems.
 - 6. Thermal hanger-shield inserts.
 - 7. Fastener systems.
 - 8. Pipe stands.
 - 9. Pipe-positioning systems.
 - 10. Equipment supports.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze pipe hangers.
 - 2. Metal framing systems.
 - 3. Fiberglass strut systems.
 - 4. Pipe stands.
 - 5. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail fabrication and assembly of trapeze hangers.
 - 2. Include design calculations for designing trapeze hangers.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.
- B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
 - 3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper Pipe and Tube Hangers:
1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.
- 2.2 TRAPEZE PIPE HANGERS
- A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.
- 2.3 METAL FRAMING SYSTEMS
- A. MFMA Manufacturer Metal Framing Systems:
1. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
 2. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
 3. Channels: Continuous slotted carbon-steel channel with inturned lips.
 4. Channel Width: Selected for applicable load criteria.
 5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Non-MFMA Manufacturer Metal Framing Systems:
1. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
 2. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
 3. Channels: Continuous slotted carbon-steel channel with inturned lips.
 4. Channel Width: Select for applicable load criteria.
 5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- 2.4 THERMAL HANGER-SHIELD INSERTS
- A. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100-psig or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with 100-psig ASTM C552, Type II cellular glass with 100-psig or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.
- 2.5 FASTENER SYSTEMS
- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Indoor Applications: Zinc-coated steel.
2. Outdoor Applications: Stainless steel.

2.6 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand:
 1. Description: Single base unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
 2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
 3. Hardware: Galvanized steel or polycarbonate.
 4. Accessories: Protection pads.
- C. Low-Profile, Single-Base, Single-Pipe Stand:
 1. Description: Single base with vertical and horizontal members, and pipe support, for roof installation without membrane protection.
 2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
 3. Vertical Members: Two galvanized-steel, continuous-thread, 1/2-inch rods.
 4. Horizontal Member: Adjustable horizontal, galvanized-steel pipe support channels.
 5. Pipe Supports: Strut clamps, Clevis hanger, Swivel hanger.
 6. Hardware: Galvanized steel.
 7. Accessories: Protection pads.
 8. Height: 12 inches above roof.
- D. High-Profile, Single-Base, Single-Pipe Stand:
 1. Description: Single base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 2. Base: Single vulcanized rubber or molded polypropylene.
 3. Vertical Members: Two galvanized-steel, continuous-thread, 1/2-inch rods.
 4. Horizontal Member: One adjustable-height, galvanized- or stainless-steel, pipe-support slotted channel or plate.
 5. Pipe Supports: Roller , Clevis hanger ,Swivel hanger.
 6. Hardware: Galvanized OR Stainless steel.
 7. Accessories: Protection pads, 1/2-inch, continuous-thread, galvanized-steel rod, 1/2-inch, continuous-thread, stainless-steel rod.
 8. Height: 36 inches above roof.
- E. High-Profile, Multiple-Pipe Stand:
 1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
 2. Bases: Two or more; vulcanized rubber.
 3. Vertical Members: Two or more, galvanized or stainless-steel channels.
 4. Horizontal Members: One or more, adjustable-height, galvanized or stainless-steel pipe support.
 5. Pipe Supports: Roller, Strut clamps, Clevis hanger or Swivel hanger.
 6. Hardware: Galvanized or Stainless steel.
 7. Accessories: Protection pads, 1/2-inch, continuous-thread rod.
 8. Height: 36 inches above roof.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 PIPE-POSITIONING SYSTEMS

- A. Description: IAPMO PS 42 positioning system composed of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.8 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-carbon-steel shapes.

2.9 MATERIALS

- A. Aluminum: ASTM B221.
- B. Carbon Steel: ASTM A1011/A1011M.
- C. Structural Steel: ASTM A36/A36M carbon-steel plates, shapes, and bars; black and galvanized.
- D. Stainless Steel: ASTM A240/A240M.
- E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-58. Install hangers and attachments as required to properly support piping from building structure.
- D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- E. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.
- F. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- G. Pipe Stand Installation:
 - 1. Pipe Stand Types, except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 07 72 00 "Roof Accessories" for curbs.
- H. Pipe-Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- I. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- K. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- L. Install lateral bracing with pipe hangers and supports to prevent swaying.
- M. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.
- N. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- P. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
 - 5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 - 6. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

- A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal hanger-shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
 12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
 17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction occurs.
 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction occurs.
 19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction occurs but vertical adjustment is unnecessary.
 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction occurs and vertical adjustment is unnecessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation, in addition to expansion and contraction, is required.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment of up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11 split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.
- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- O. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- R. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Stencils.
 - 5. Valve tags.
 - 6. Warning tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: Brass, 0.032-inch, stainless steel, 0.025-inch aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Letter Color: White.
 - 3. Background Color: Black.
 - 4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 - 6. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: Black.
 - 3. Background Color: White.
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 7. Fasteners: Stainless-steel rivets or self-tapping screws.
 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Red.
- C. Background Color: Red.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 2. Lettering Size: Size letters according to ASME A13.1 for piping At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

2.4 STENCILS

- A. Stencils for Piping:
 1. Lettering Size: Size letters according to ASME A13.1 for piping At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.
 2. Stencil Material: Brass.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Stencil Paint: Exterior, gloss, alkyd enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
4. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.

2.5 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 2. Fasteners: Brass wire-link chain or beaded chain or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

- A. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.
 1. Size: 3 by 5-1/4 inches minimum.
 2. Fasteners: Brass grommet and wire.
 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 4. Color: Safety yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

- A. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.
 1. Identification Paint: Use for contrasting background.
 2. Stencil Paint: Use for pipe marking.
- B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 1. Near each valve and control device.
 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 5. Near major equipment items and other points of origination and termination.
 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- D. Pipe Label Color Schedule:
1. Low-Pressure Compressed Air Piping:
 - a. Background: Safety blue.
 - b. Letter Colors: White.
 2. High-Pressure Compressed Air Piping:
 - a. Background: Safety blue.
 - b. Letter Colors: White.
 3. Domestic Water Piping
 - a. Background: Safety green.
 - b. Letter Colors: White.
 4. Sanitary Waste and Storm Drainage Piping:
 - a. Background Color: Safety black.
 - b. Letter Color: White.

3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
1. Valve-Tag Size and Shape:
 - a. Cold Water: 1-1/2 inches, round.
 - b. Hot Water: 1-1/2 inches, round.
 - c. Low-Pressure Compressed Air: 1-1/2 inches, round.
 - d. High-Pressure Compressed Air: 1-1/2 inches, round.
 2. Valve-Tag Colors:
 - a. Cold Water: Natural.
 - b. Hot Water: Natural.
 - c. Low-Pressure Compressed Air: Natural.
 - d. High-Pressure Compressed Air: Natural.
 3. Letter Colors:
 - a. Cold Water: White.
 - b. Hot Water: White.
 - c. Low-Pressure Compressed Air: White.
 - d. High-Pressure Compressed Air: White.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3.6 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 22 07 19 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes insulating the following plumbing piping services:
 - 1. Domestic cold-water piping.
 - 2. Domestic hot-water piping.
 - 3. Domestic recirculating hot-water piping.
 - 4. Domestic chilled-water piping for drinking fountains.
 - 5. Sanitary waste piping exposed to freezing conditions.
 - 6. Storm-water piping exposed to freezing conditions.
 - 7. Roof drains and rainwater leaders.
 - 8. Supplies and drains for handicap-accessible lavatories and sinks.
- B. Related Sections:
 - 1. Section 22 07 16 "Plumbing Equipment Insulation" for equipment insulation.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).
- B. Sustainable Design Submittals.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Detail removable insulation at piping specialties, equipment connections, and access panels.
 - 6. Detail application of field-applied jackets.
 - 7. Detail application at linkages of control devices.
- D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:
 - 1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
 - 2. Jacket Materials for Pipe: 12 inches long by NPS 2.
 - 3. Sheet Jacket Materials: 12 inches square.
 - 4. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less and smoke-developed index of 150 or less.
- C. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come into contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable in accordance with ASTM C795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Comply with ASTM C552.
 - 1. Preformed Pipe Insulation: Type II, Class 1, without jacket.
 - 2. Preformed Pipe Insulation: Type II, Class 2, with factory-applied ASJ jacket.
 - 3. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
 - 4. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- G. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534/C534M, Type I for tubular materials.
- H. Mineral-Fiber, Preformed Pipe: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C547.
 - 1. Preformed Pipe Insulation: Type I, Grade A, without factory-applied jacket with factory-applied ASJ.
 - 2. 850 deg F.
 - 3. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
 - 4. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C195.
- B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C196.
- C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C449.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.
- C. Flexible Elastomeric and Polyolefin Adhesive: Solvent-based adhesive.
 - 1. Flame-spread index shall be 25 or less and smoke-developed index shall be 50 or less as tested in accordance with ASTM E84.
 - 2. Wet Flash Point: Below 0 deg F.
 - 3. Service Temperature Range: 40 to 200 deg F.
 - 4. Color: Black.
- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- E. Phenolic Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
- F. ASJ Adhesive and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.
- G. PVC Jacket Adhesive: Compatible with PVC jacket.

2.4 MASTICS AND COATINGS

- A. Materials shall be compatible with insulation materials, jackets, and substrates.
- B. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.
 - 1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
 - 2. Service Temperature Range: 0 to plus 180 deg F.
 - 3. Comply with MIL-PRF-19565C, Type II, for permeance requirements, with supplier listing on DOD QPD - Qualified Products Database.
 - 4. Color: White.
- C. Vapor-Retarder Mastic, Solvent Based, Indoor Use: Suitable for indoor use on below-ambient services.
 - 1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
 - 2. Service Temperature Range: 0 to 180 deg F.
 - 3. Color: White.
- D. Vapor-Retarder Mastic, Solvent Based, Outdoor Use: Suitable for outdoor use on below-ambient services.
 - 1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
 - 2. Service Temperature Range: Minus 50 to plus 220 deg F.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Water-Vapor Permeance: ASTM E96/E96M, greater than 1.0 perm at manufacturer's recommended dry film thickness.

2. Service Temperature Range: 0 to plus 180 deg F.

3. Color: White.

2.5 LAGGING ADHESIVES

A. Adhesives shall comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.

1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.

2. Service Temperature Range: 20 to plus 180 deg F.

3. Color: White.

2.6 SEALANTS

A. Materials shall be as recommended by the insulation manufacturer and shall be compatible with insulation materials, jackets, and substrates.

B. Joint Sealants:

1. Permanently flexible, elastomeric sealant.

2. Service Temperature Range: Minus 58 to plus 176 deg F.

3. Color: White or gray.

C. FSK and Metal Jacket Flashing Sealants:

1. Fire- and water-resistant, flexible, elastomeric sealant.

2. Service Temperature Range: Minus 40 to plus 250 deg F.

3. Color: Aluminum.

D. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Fire- and water-resistant, flexible, elastomeric sealant.

2. Service Temperature Range: Minus 40 to plus 250 deg F.

3. Color: White.

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.

2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.

3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

2.9 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

2.10 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C1136, Type I, unless otherwise indicated.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - 1. Adhesive: As recommended by jacket material manufacturer.
 - 2. Color: Color-code jackets based on system. Color as selected by Architect.
 - 3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- D. Metal Jacket:
 - 1. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Factory cut and rolled to size.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
 - d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
 - e. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.
 - 7) Valve covers.
 - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
 - 2. Stainless-Steel Jacket: ASTM A240/A240M.
 - a. Factory cut and rolled to size.
 - b. Material, finish, and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
 - d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
 - e. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.
 - 7) Valve covers.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

- E. Underground Direct-Buried Jacket: 125-mil-thick vapor barrier and waterproofing membrane, consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.
- F. Self-Adhesive Outdoor Jacket: 60-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a cross-laminated polyethylene film covered with white aluminum-foil facing.

2.11 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
 - 1. Width: 3 inches.
 - 2. Thickness: 11.5 mils.
 - 3. Adhesion: 90 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch in width.
 - 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.
 - 1. Width: 3 inches.
 - 2. Thickness: 6.5 mils.
 - 3. Adhesion: 90 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch in width.
 - 6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
 - 1. Width: 2 inches.
 - 2. Thickness: 6 mils.
 - 3. Adhesion: 64 ounces force/inch in width.
 - 4. Elongation: 500 percent.
 - 5. Tensile Strength: 18 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 - 1. Width: 2 inches.
 - 2. Thickness: 3.7 mils.
 - 3. Adhesion: 100 ounces force/inch in width.
 - 4. Elongation: 5 percent.
 - 5. Tensile Strength: 34 lbf/inch in width.

2.12 SECUREMENTS

- A. Bands:
 - 1. Stainless Steel: ASTM A240/A240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal or closed seal.
 - 2. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- C. Wire: 0.080-inch nickel-copper alloy.

2.13 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers,;
 - 1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.
- B. Protective Shielding Piping Enclosures,;
 - 1. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 - 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range of between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 - 2. Carbon Steel: Coat carbon steel operating at a service temperature of between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
 - 3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
 - K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
 - L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
 - M. Cut insulation in a manner to avoid compressing insulation more than 25 percent of its nominal thickness.
 - N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
 - O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.
 - P. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Cleanouts.
- 3.4 PENETRATIONS
- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as that of adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

6. Insulate flanges, mechanical couplings, and unions, using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
 4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as that of pipe insulation.
 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as that of straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
 2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of cellular-glass insulation to valve body.
 2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.
- 3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION
- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed valve covers manufactured of same material as that of pipe insulation when available.
 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.
 4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- 3.8 INSTALLATION OF MINERAL-FIBER INSULATION
- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as that of straight segments of pipe insulation when available.
 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as that of straight segments of pipe insulation when available.
 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 4. Install insulation to flanges as specified for flange insulation application.
- 3.9 INSTALLATION OF PHENOLIC INSULATION
- A. General Installation Requirements:
1. Secure single-layer insulation with stainless steel bands at 12-inch intervals, and tighten bands without deforming insulation materials.
 2. Install two-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with 0.062-inch wire spaced at 12-inch intervals. Secure outer layer with stainless steel bands at 12-inch intervals.
- B. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
 4. For insulation with factory-applied jackets with vapor retarders on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.
- C. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as that of pipe insulation.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- D. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install preformed insulation sections of same material as that of straight segments of pipe insulation. Secure according to manufacturer's written instructions.
- E. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed insulation sections of same material as that of straight segments of pipe insulation. Secure according to manufacturer's written instructions.
 - 2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 3. Install insulation to flanges as specified for flange insulation application.

3.10 INSTALLATION OF POLYOLEFIN INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
 - 1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 - 1. Install pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as that of pipe insulation.
 - 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install mitered sections of polyolefin pipe insulation.
 - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
 - 2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 3. Install insulation to flanges as specified for flange insulation application.
 - 4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.11 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
 - 1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
 - 2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
 - 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
 - 1. Draw jacket material smooth and tight.
 - 2. Install lap or joint strips with same material as jacket.
 - 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 - 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
 - C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
 - D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.
- 3.12 FINISHES
- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
 - B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
 - C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
 - D. Do not field paint aluminum or stainless steel jackets.
- 3.13 FIELD QUALITY CONTROL
- A. Owner will engage a qualified testing agency to perform tests and inspections.
 - B. Engage a qualified testing agency to perform tests and inspections.
 - C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
 - D. Perform tests and inspections.
 - E. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
 - F. All insulation applications will be considered defective if they do not pass tests and inspections.
 - G. Prepare test and inspection reports.
- 3.14 PIPING INSULATION SCHEDULE, GENERAL
- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
 - B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 1. Drainage piping located in crawl spaces.
 2. Underground piping.
 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.
- 3.15 INDOOR PIPING INSULATION SCHEDULE
- A. Domestic Cold Water:
 1. NPS 1 and Smaller: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 3/4 inch thick.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. NPS 1-1/4 and Larger: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - B. Domestic Hot and Recirculated Hot Water:
 1. NPS 1-1/4 and Smaller: Insulation shall be the following:
 - a. Flexible Elastomeric: 3/4 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 2. NPS 1-1/2 and Larger: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - C. Stormwater and Overflow:
 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - D. Roof Drain and Overflow Drain Bodies:
 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1/2 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
 - F. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:
 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 3/4 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
 - G. Hot Service Drains:
 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Cellular Glass: 1-1/2 inches thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - H. Hot Service Vents:
 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Cellular Glass: 1-1/2 inches thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- 3.16 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE
- A. Sanitary Waste Piping, All Sizes, Where Heat Tracing Is Installed: Cellular glass, 2 inches thick.
 - B. Chilled Water, All Sizes: Cellular glass, 2 inches thick.
- 3.17 INDOOR, FIELD-APPLIED JACKET SCHEDULE
- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
 - B. If more than one material is listed, selection from materials listed is Contractor's option.
 - C. Piping, Concealed:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. PVC: 20 mils thick.
 2. Aluminum, Smooth: 0.020 inch thick.
 3. Painted Aluminum, Smooth: 0.020 inch thick.
 4. Stainless Steel, Type 304 or Type 316, Smooth No. 2B Finish: 0.020 inch thick.
- D. Piping, Exposed:
1. PVC: 20 mils thick.
 2. Aluminum, Smooth: 0.020 inch thick.
 3. Painted Aluminum, Smooth: 0.020 inch thick.
 4. Stainless Steel, Type 304 or Type 316, Smooth No. 2B Finish: 0.016 inch thick.
- 3.18 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE
- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
1. PVC: 20 mils thick.
 2. Aluminum, Smooth: 0.020 inch thick.
 3. Painted Aluminum, Smooth: 0.020 inch thick.
 4. Stainless Steel, Type 304 or Type 316, Smooth No. 2B Finish: 0.016 inch thick.
- D. Piping, Exposed:
1. PVC: 30 mils thick.
 2. Painted Aluminum, Smooth with Z-Shaped Locking Seam: 0.020 inch thick.
 3. Stainless Steel, Type 304 or Type 316, Smooth No. 2B Finish with Z-Shaped Locking Seam: 0.016 inch thick.
- 3.19 UNDERGROUND, FIELD-APPLIED INSULATION JACKET
- A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION

SECTION 22 11 16 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Ductile-iron pipe and fittings.
3. Galvanized-steel pipe and fittings.
4. Stainless steel piping and fittings.
5. CPVC piping.
6. PEX tube and fittings.
7. PEX-AL-PEX tube and fittings.
8. PEX-AL-HDPE tube and fittings.
9. PVC pipe and fittings.
10. PP-R pipe and fittings.
11. Piping joining materials.
12. Encasement for piping.
13. Transition fittings.
14. Dielectric fittings.

B. Related Requirements:

1. Section 22 11 13 "Facility Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Pipe and tube.
2. Fittings.
3. Joining materials.
4. Transition fittings.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
3. Environmental Product Declaration: For each product.
4. Health Product Declaration: For each product.
5. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Piping layout, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.
- B. System purging and disinfecting activities report.
- C. Field quality-control reports.

1.5 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Notify Architect no fewer than two days in advance of proposed interruption of water service.
2. Do not interrupt water service without Architect's written permission.

1.6 WARRANTY

- A. Polypropylene Piping (PP-R) Manufacturer's Warranty: Manufacturer agrees to repair or replace PP-R pipe and fittings that fail in materials or workmanship within 10 years from date of Substantial Completion.
1. Warranty is to cover labor and material costs of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of the piping system due to defects in materials or manufacturing.
 2. Warranty is to be in effect only upon submission by the Contractor to the manufacturer of valid pressure/leak documentation indicating that the system was tested and passed the manufacturer's pressure/leak test.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372.

2.2 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tube: ASTM B88, Type K.
- B. Annealed-Temper Copper Tube: ASTM B88, Type K and ASTM B88, Type M.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings.
- E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- F. Cast Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
- G. Wrought Copper Unions: ASME B16.22.
- H. Copper-Tube, Mechanically Formed Tee Fitting: For forming T-branch on copper water tube.
1. Description: Tee formed in copper tube in accordance with ASTM F2014.
- I. Grooved, Mechanical-Joint, Copper Tube Appurtenances:
1. Grooved-End, Copper Fittings: ASTM B75 copper tube or ASTM B584 bronze castings.
 2. Grooved-End-Tube Couplings: To fit copper-tube dimensions; rigid pattern unless otherwise indicated; gasketed fitting, EPDM-rubber gasket, UL classified per NSF 61 and NSF 372, and rated for minimum 180 deg F, for use with ferrous housing and steel bolts and nuts; 300 psig minimum CWP pressure rating.
- J. Copper Tube, Pressure-Seal-Joint Fittings:
1. Fittings: Cast-brass, cast-bronze, or wrought-copper with EPDM O-ring seal in each end.
 2. Minimum 200-psig working-pressure rating at 250 deg F.
- K. Copper-Tube, Push-on-Joint Fittings:
1. Description:
 - a. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.
 - b. Stainless steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.

2.3 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe:
1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
 - B. Standard-Pattern, Mechanical-Joint Fittings:
 1. AWWA C110/A21.10, ductile or gray iron.
 2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
 - C. Compact-Pattern, Mechanical-Joint Fittings:
 1. AWWA C153/A21.53, ductile iron.
 2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
 - D. Push-on-Joint, Ductile-Iron Pipe:
 1. AWWA C151/A21.51.
 2. Push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 - E. Standard-Pattern, Push-on-Joint Fittings:
 1. AWWA C110/A21.10, ductile or gray iron.
 2. Gaskets: AWWA C111/A21.11, rubber.
 - F. Compact-Pattern, Push-on-Joint Fittings:
 1. AWWA C153/A21.53, ductile iron.
 2. Gaskets: AWWA C111/A21.11, rubber.
 - G. Plain-End, Ductile-Iron Pipe: AWWA C151/A21.51.
 - H. Appurtenances for Grooved-End, Ductile-Iron Pipe:
 1. Fittings for Grooved-End, Ductile-Iron Pipe: ASTM A47/A47M, malleable-iron castings or ASTM A536, ductile-iron castings with dimensions that match pipe.
 2. Mechanical Couplings for Grooved-End, Ductile-Iron-Piping:
 - a. AWWA C606 for ductile-iron-pipe dimensions.
 - b. Ferrous housing sections.
 - c. EPDM-rubber gaskets suitable for hot and cold water.
 - d. Bolts and nuts.
 - e. Minimum Pressure Rating:
 - 1) NPS 14 to NPS 18: 250 psig.
 - 2) NPS 20 to NPS 46: 150 psig.
- 2.4 GALVANIZED-STEEL PIPE AND FITTINGS
- A. Galvanized-Steel Pipe:
 1. ASTM A53/A53M, Type E,, Standard Weight.
 2. Include ends matching joining method.
 - B. Galvanized-Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M or ASTM A106/A106M, Standard Weight, seamless steel pipe with threaded ends.
 - C. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
 - D. Malleable-Iron Unions:
 1. ASME B16.39, Class 150.
 2. Hexagonal-stock body.
 3. Ball-and-socket, metal-to-metal, bronze seating surface.
 4. Threaded ends.
 - E. Flanges: ASME B16.1, Class 125, cast iron.
 - F. Appurtenances for Grooved-End, Galvanized-Steel Pipe:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. ASTM Fittings for Grooved-End, Galvanized-Steel Pipe: Galvanized, ASTM A47/A47M, malleable-iron casting; ASTM A106/A106M, steel pipe; or ASTM A536, ductile-iron casting; with dimensions matching steel pipe.
2. AWWA Fittings for Grooved-End, Galvanized-Steel Pipe:
 - a. AWWA C606 for steel-pipe dimensions.
 - b. Ferrous housing sections.
 - c. EPDM-rubber gaskets suitable for hot and cold water.
 - d. Bolts and nuts.
 - e. Minimum Pressure Rating:
 - 1) NPS 8 and Smaller: 600 psig.

2.5 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials:
 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
 2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B32, lead-free alloys.
- D. Flux: ASTM B813, water flushable.
- E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
- F. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F493.
 1. Verify solvent cement has a VOC content of 490 g/L or less.
 2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- G. Solvent Cements for Joining PVC Piping: ASTM D2564. Include primer according to ASTM F656.
 1. Verify solvent cement has a VOC content of 510 g/L or less.
 2. <Double click to insert sustainable design text for adhesive primer.>
 3. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 4. Verify adhesive primer complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- H. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.6 ENCASEMENT FOR PIPING

- A. Standard: ASTM A674 or AWWA C105/A21.5.
- B. Form: Sheet or tube.
- C. Color: Black or natural.

2.7 TRANSITION FITTINGS

- A. General Requirements:
 1. Same size as pipes to be joined.
 2. Pressure rating at least equal to pipes to be joined.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. End connections compatible with pipes to be joined.
 - B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
 - C. Sleeve-Type Transition Coupling: AWWA C219.
 - D. Plastic-to-Metal Transition Fittings:
 1. Description:
 - a. CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
 - b. One end with threaded brass insert and one solvent-cement-socket or threaded end.
 - E. Plastic-to-Metal Transition Unions:
 1. Description:
 - a. CPVC or PVC four-part union.
 - b. Brass or stainless steel threaded end.
 - c. Solvent-cement-joint or threaded plastic end.
 - d. Rubber O-ring.
 - e. Union nut.
- 2.8 DIELECTRIC FITTINGS
- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
 - B. Dielectric Unions:
 1. Standard: ASSE 1079.
 2. Pressure Rating: 150 psig.
 3. End Connections: Solder-joint copper alloy and threaded ferrous.
 - C. Dielectric Flanges:
 1. Standard: ASSE 1079.
 2. Factory-fabricated, bolted, companion-flange assembly.
 3. Pressure Rating: 150 psig.
 4. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
 - D. Dielectric-Flange Insulating Kits:
 1. Nonconducting materials for field assembly of companion flanges.
 2. Pressure Rating: 150 psig.
 3. Gasket: Neoprene or phenolic.
 4. Bolt Sleeves: Phenolic or polyethylene.
 5. Washers: Phenolic with steel backing washers.
 - E. Dielectric Nipples:
 1. Standard: IAPMO PS 66.
 2. Electroplated steel nipple complying with ASTM F1545.
 3. Pressure Rating and Temperature: 300 psig at 225 deg F.
 4. End Connections: Male threaded or grooved.
 5. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be one of the following:
 - 1. Annealed-temper copper tube, ASTM B88, Type K; joints.
- E. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 and larger, shall be one of the following:
 - 1. Annealed-temper copper tube, ASTM B88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
 - 2. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
- F. Under-building-slab, combined domestic water, building-service, and fire-service-main piping, NPS 6 to NPS 12, shall be one of the following:
 - 1. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
- G. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be one of the following:
 - 1. Drawn-temper or annealed-temper copper tube, ASTM B88, Type L; wrought-copper, solder-joint fittings; and brazed copper pressure-seal-joint fittings; and pressure-sealed joints.
- H. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
 - 1. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
 - 2. Drawn-temper copper tube, ASTM B88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed or soldered joints.
 - 3. Drawn-temper copper tube, ASTM B88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
 - 4. Drawn-temper copper tube, ASTM B88, Type L; copper push-on-joint fittings; and push-on joints.
- I. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be one of the following:
 - 1. Drawn-temper copper tube, ASTM B88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed or soldered joints.
 - 2. Drawn-temper copper tube, ASTM B88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
 - 3. Drawn-temper copper tube, ASTM B88, Type L; grooved-joint, copper-tube appurtenances; and grooved joints.
 - 4. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
 - 5. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.
- J. Aboveground, combined domestic water-service and fire-service-main piping, NPS 6 to NPS 12, shall be one of the following:
 - 1. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
3. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

3.2 EARTHWORK

- A. Comply with requirements in Section 31 20 00 "Earth Moving" for excavating, trenching, and backfilling.

3.3 INSTALLATION OF PIPING

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install underground copper tube and ductile-iron pipe in PE encasement according to ASTM A674 or AWWA C105/A21.5.
- E. Install valves according to the following:
 1. Section 22 05 23.12 "Ball Valves for Plumbing Piping."
 2. Section 22 05 23.13 "Butterfly Valves for Plumbing Piping."
 3. Section 22 05 23.14 "Check Valves for Plumbing Piping."
 4. Section 22 05 23.15 "Gate Valves for Plumbing Piping."
- F. Install domestic water piping level without pitch and plumb.
- G. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- H. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- J. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- L. Install piping to permit valve servicing.
- M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- N. Install piping free of sags and bends.
- O. Install fittings for changes in direction and branch connections.
- P. Install PEX tubing with loop at each change of direction of more than 90 degrees.
- Q. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- R. Install pressure gauges on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gauges in Section 22 05 19 "Meters and Gages for Plumbing Piping."
- S. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 22 11 23 "Domestic Water Pumps."
- T. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 22 05 19 "Meters and Gages for Plumbing Piping."

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

3.4 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Braze Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B828 or CDA's "Copper Tube Handbook."
- F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools and procedure recommended by pressure-seal-fitting manufacturer. Leave insertion marks on pipe after assembly.
- G. Push-on Joints for Copper Tubing: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.
- H. Extruded-Tee Connections: Form tee in copper tube according to ASTM F2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
- I. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.
- J. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.
- K. Joint Construction for Grooved-End Steel Piping: Make joints according to AWWA C606. Square cut groove ends of pipe as specified. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.
- L. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- M. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
 - 2. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.

3. PVC Piping: Join according to ASTM D2855.
 - N. Joints for PEX Tubing, ASTM: Join according to ASTM F1807 for metal insert and copper crimp ring fittings and ASTM F1960 for cold expansion fittings and reinforcing rings.
 - O. Joints for PEX Tubing, ASSE: Join according to ASSE 1061 for push-fit fittings.
 - P. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.
- 3.5 INSTALLATION OF TRANSITION FITTINGS
- A. Install transition couplings at joints of dissimilar piping.
 - B. Transition Fittings in Underground Domestic Water Piping:
 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
 2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
 - C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.
- 3.6 INSTALLATION OF DIELECTRIC FITTINGS
- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
 - B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.
 - C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flange kits.
 - D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.
- 3.7 INSTALLATION OF HANGERS AND SUPPORTS
- A. Comply with requirements for seismic-restraint devices specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
 - B. Comply with requirements for hangers, supports, and anchor devices in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
 - C. Install hangers for copper, ductile iron, galvanized steel, and stainless steel tubing and piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
 - D. Support horizontal piping within 12 inches of each fitting.
 - E. Support vertical runs of copper, ductile iron, galvanized steel, and stainless steel tubing and piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- 3.8 CONNECTIONS
- A. Drawings indicate general arrangement of piping, fittings, and specialties.
 - B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
 - C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
 - D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
 4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3.9 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.10 ADJUSTING

- A. Perform the following adjustments before operation:
1. Close drain valves, hydrants, and hose bibbs.
 2. Open shutoff valves to fully open position.
 3. Open throttling valves to proper setting.
 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
 - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
 2. Piping Tests:
 - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
 - f. Prepare reports for tests and for corrective action required.
 - B. Domestic water piping will be considered defective if it does not pass tests and inspections.
 - C. Prepare test and inspection reports.
- 3.12 CLEANING
 - A. Clean and disinfect potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.
 - B. Clean non-potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
 - C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
 - D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION

SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Automatic water shutoff valve systems.
5. Balancing valves.
6. Temperature-actuated, water mixing valves.
7. Strainers for domestic water piping.
8. Outlet boxes.
9. Hose stations.
10. Hose bibbs.
11. Wall hydrants.
12. Ground hydrants.
13. Post hydrants.
14. Roof hydrants.
15. Drain valves.
16. Water-hammer arresters.
17. Trap-seal primer device.
18. Trap-seal primer systems.
19. Flexible connectors.
20. Water meters.

B. Related Requirements:

1. Section 21 11 00 "Facility Fire-Suppression Water-Service Piping" for fire water-service backflow prevention devices.
2. Section 22 05 19 "Meters and Gauges for Plumbing Piping" for thermometers, pressure gauges, and flow meters in domestic water piping.
3. Section 22 11 16 "Domestic Water Piping" for water meters.
4. Section 22 32 00 "Domestic Water Filtration Equipment" for water filters in domestic water piping.
5. Section 22 43 00 "Healthcare Plumbing Fixtures" for thermostatic mixing valves for sitz baths, thermostatic mixing-valve assemblies for hydrotherapy equipment, and outlet boxes for dialysis equipment.
6. Section 22 45 00 "Emergency Plumbing Fixtures" for water tempering equipment.
7. Section 22 47 16 "Pressure Water Coolers" for water filters for water coolers.
8. Section 22 47 23 "Remote Water Coolers" for water filters for water coolers.
9. Section 23 09 23.18 "Leak Detection Instruments" for leak detection devices related to HVAC applications.

1.3 DEFINITIONS

- A. AMI: Advanced Metering Infrastructure.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. AMR: Automatic Meter Reading.
- C. FKM: A family of fluoroelastomer materials defined by ASTM D1418.
- 1.4 ACTION SUBMITTALS
 - A. Product Data: For each type of product.
 - B. Shop Drawings: For domestic water piping specialties.
 - 1. Include diagrams for power, signal, and control wiring.
- 1.5 INFORMATIONAL SUBMITTALS
 - A. Test and inspection reports.
 - B. Field quality-control reports.
- 1.6 CLOSEOUT SUBMITTALS
 - A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

- 2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES
 - A. Domestic water piping specialties intended to convey or dispense water for human consumption are to comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or to be certified in compliance with NSF 61 and NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
- 2.2 PERFORMANCE REQUIREMENTS
 - A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.
- 2.3 VACUUM BREAKERS
 - A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
 - 1. Standard: ASSE 1001.
 - 2. Size: NPS 1/4 to NPS 3, as required to match connected piping.
 - 3. Body: Bronze.
 - 4. Inlet and Outlet Connections: Threaded.
 - 5. Finish: Rough bronze or Chrome plated.
 - B. Hose-Connection Vacuum Breakers:
 - 1. Standard: ASSE 1011.
 - 2. Body: Bronze, nonremovable, with manual drain.
 - 3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
 - 4. Finish: Chrome or nickel plated.
 - C. Pressure Vacuum Breakers:
 - 1. Standard: ASSE 1020.
 - 2. Operation: Continuous-pressure applications.
 - 3. Pressure Loss: 5 psig maximum, through middle third of flow range.
- 2.4 BACKFLOW PREVENTERS
 - A. Intermediate Atmospheric-Vent Backflow Preventers:
 - 1. Standard: ASSE 1012.
 - 2. Operation: Continuous-pressure applications.
 - 3. Size: NPS 1/2.
 - 4. Body: Bronze.
 - 5. End Connections: Union, solder joint.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

6. Finish: Rough bronze.
 - B. Reduced-Pressure-Principle Backflow Preventers:
 1. Standard: ASSE 1013.
 2. Operation: Continuous-pressure applications.
 3. Pressure Loss: 8 psig maximum, through middle third of flow range.
 4. Accessories:
 - a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
 - b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
 - c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
 - C. Double-Check, Backflow-Prevention Assemblies:
 1. Standard: ASSE 1015.
 2. Operation: Continuous-pressure applications unless otherwise indicated.
 3. Pressure Loss: 5 psig maximum, through middle third of flow range.
 - D. Dual-Check-Valve Backflow Preventers:
 1. Standard: ASSE 1024.
 2. Operation: Continuous-pressure applications.
 - E. Hose-Connection Backflow Preventers:
 1. Standard: ASSE 1052.
 2. Operation: Up to 10-foot head of water back pressure.
 3. Inlet Size: NPS 3/4.
 4. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
 5. Capacity: At least 3-gpm flow.
 - F. Backflow-Preventer Test Kits:
 1. Description: Factory calibrated, with gauges, fittings, hoses, and carrying case with test-procedure instructions.
- 2.5 WATER PRESSURE-REDUCING VALVES
- A. Water Regulators Insert drawing designation if any:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Flow Controls; Conbraco Industries, Inc.
 - b. Cash Acme, A Division of Reliance Worldwide Corporation.
 - c. WATTS.
 - d. Zurn Industries, LLC.
 2. Standard: ASSE 1003.
 3. Pressure Rating: Initial working pressure of 150 psig.
 4. Body: Bronze for NPS 2 and smaller; bronze or cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
 5. Valves for Booster Heater Water Supply: Include integral bypass.
 6. End Connections: Threaded or solder for NPS 2 and smaller; flanged or solder for NPS 2-1/2 and NPS 3.
 - B. Water-Control Valves:
 1. Description: Pilot-operated, diaphragm-type, single-seated, main water-control valve.
 2. Pressure Rating: Initial working pressure of 150 psig minimum with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot-control valve, restrictor device, specialty fittings, and sensor piping.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless steel body.
 - a. Pattern: Angle or Globe-valve design.
 - b. Trim: Stainless steel.
4. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

2.6 BALANCING VALVES

- A. Copper-Alloy Calibrated Balancing Valves:
 1. Type: Ball valve with two readout ports and memory-setting indicator.
 2. Body: Brass or bronze.
 3. Size: Same as connected piping, but not larger than NPS 2.
 4. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.
- B. Automatic Flow Control Balancing Valves:
 1. Flow Regulation: Plus or minus 5 percent over 95 percent of the working range.
 2. Pressure Rating: 200 psig.
 3. Size: NPS 2 or smaller.
 4. Body: Stainless steel or brass.
 5. Flow Cartridge: Stainless steel or antiscaling polymer.
 6. End Connections: Threaded or solder joint.

2.7 TEMPERATURE-ACTUATED, WATER MIXING VALVES

- A. Water-Temperature Limiting Devices:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acorn Engineering Company; a Division of Morris Group International.
 - b. Apollo Flow Controls; Conbraco Industries, Inc.
 - c. Cash Acme, A Division of Reliance Worldwide Corporation.
 - d. Leonard Valve Company.
 - e. POWERS; A WATTS Brand.
 - f. Symmons Industries, Inc.
 - g. TACO Comfort Solutions, Inc.
 - h. WATTS.
 - i. Zurn Industries, LLC.
 2. Standard: ASSE 1070.
 3. Pressure Rating: 125 psig.
 4. Type: Thermostatically controlled, water mixing valve.
 5. Material: Bronze body with corrosion-resistant interior components.
 6. Connections: Threaded union inlets and outlet.
 7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
 8. Tempered-Water Setting: 110 deg F.
 9. Valve Finish: Chrome plated.
- B. Individual-Fixture, Water Tempering Valves:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lawler Manufacturing Company, Inc.
 - b. POWERS; A WATTS Brand.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- c. Zurn Industries, LLC.
 2. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
 3. Pressure Rating: 125 psig minimum unless otherwise indicated.
 4. Material: Bronze body with corrosion-resistant interior components.
 5. Temperature Control: Adjustable.
 6. Connections: Threaded inlets and outlet.
 7. Finish: Chrome plated.
 8. Tempered-Water Setting: 110 deg-F.
- 2.8 STRAINERS FOR DOMESTIC WATER PIPING
- A. Y-Pattern Strainers:
1. Pressure Rating: 125 psig minimum unless otherwise indicated.
 2. Body: Bronze for NPS 2 and smaller; cast iron for NPS 2-1/2 and larger.
 3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
 4. Screen: Stainless steel with round perforations unless otherwise indicated.
 5. Drain: Pipe plug.
- 2.9 OUTLET BOXES
- A. Clothes Washer Outlet Boxes:
1. Mounting: Recessed. Fire rated.
 2. Material and Finish: Enameled-steel or epoxy-painted-steel, Enameled-steel, epoxy-painted-steel, or plastic, Plastic, Stainless steel box and faceplate.
 3. Faucet: Combination valved fitting or separate hot- and cold-water valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
 4. Drain Outlet Connection: NPS 1-1/2.
 5. Accessory: Water hammer arresters.
 6. Supply Shutoff Fittings: NPS 1/2 gate, globe, or ball valves and NPS 1/2 copper, water tubing.
 7. Drain: NPS 1-1/2 standpipe and P-trap for direct waste connection to drainage piping.
 8. Inlet Hoses: Two 60-inch-long, rubber, household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
 9. Drain Hose: One 48-inch-long, rubber, household clothes washer drain hose with hooked end.
- B. IceMaker Outlet Boxes:
1. Mounting: Recessed.
 2. Material and Finish: Enameled-steel or epoxy-painted-steel, Enameled-steel, epoxy-painted-steel, or plastic, Plastic, Stainless steel box and faceplate.
 3. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
 4. Accessory: Water hammer arrestor.
 5. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.
- 2.10 HOSE BIBBS
- A. Hose Bibbs:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg Co; a division of Morris Group International.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- b. MIFAB, Inc.
 - c. Prier Products, Inc.
 - d. WATTS.
 - e. Woodford Manufacturing Company.
 - f. Zurn Industries, LLC.
2. Standard: ASME A112.18.1 for sediment faucets.
 3. Body Material: Bronze.
 4. Seat: Bronze, replaceable.
 5. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
 6. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
 7. Pressure Rating: 125 psig.
 8. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
 9. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
 10. Finish for Service Areas: Rough bronze.
 11. Finish for Finished Rooms: Chrome or nickel plated.
 12. Operation for Equipment Rooms: Wheel handle or operating key.
 13. Operation for Service Areas: Operating key.
 14. Operation for Finished Rooms: Wheel handle.
 15. Include operating key with each operating-key hose bibb.
 16. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.11 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:

1. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
2. Pressure Rating: 125 psig.
3. Operation: Loose key.
4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
5. Inlet: NPS 3/4 or NPS 1.
6. Outlet, Concealed: With integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounted with cover.
8. Box and Cover Finish: Polished nickel bronze.
9. Nozzle and Wall-Plate Finish: Polished nickel bronze.
10. Operating Keys(s): Two with each wall hydrant.

B. Nonfreeze, Hot- and Cold-Water Wall Hydrants Insert drawing designation if any:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg Co; a division of Morris Group International.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. Prier Products, Inc.
 - e. WATTS.
 - f. Woodford Manufacturing Company.
 - g. Zurn Industries, LLC.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rods: Of length required to match wall thickness. Include wall clamps.
6. Inlet: NPS 3/4 or NPS 1.
7. Outlet: Concealed.
8. Box: Deep, flush mounted with cover.
9. Box and Cover Finish: Polished nickel bronze.
10. Vacuum Breaker:
 - a. Nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
 - b. Garden-hose thread complying with ASME B1.20.7 on outlet.
11. Operating Key(s): Two with each wall hydrant.

C. Nonfreeze Vacuum Breaker Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg Co; a division of Morris Group International.
 - b. Prier Products, Inc.
 - c. WATTS.
 - d. Woodford Manufacturing Company.
 - e. Zurn Industries, LLC.
2. Standard: ASSE 1019, Type A or Type B.
3. Type: Automatic draining with integral air-inlet valve.
4. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
5. Pressure Rating: 125 psig.
6. Operation: Loose key or wheel handle.
7. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
8. Inlet: NPS 1/2 or NPS 3/4.
9. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.12 GROUND HYDRANTS

A. Nonfreeze Ground Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg Co; a division of Morris Group International.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. Prier Products, Inc.
 - e. WATTS.
 - f. Woodford Manufacturing Company.
 - g. Zurn Industries, LLC.
2. Standard: ASME A112.21.3M.
3. Type: Nonfreeze, concealed-outlet ground hydrant with box.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

4. Operation: Loose key.
5. Casing and Operating Rod: Of at least length required for burial of valve below frost line.
6. Inlet: NPS 3/4.
7. Outlet: Garden-hose thread complying with ASME B1.20.7.
8. Drain: Designed with hole to drain into ground when shut off.
9. Box: Standard pattern with cover.
10. Box and Cover Finish: Rough bronze.
11. Operating Key(s): Two with each ground hydrant.
12. Vacuum Breaker: ASSE 1011.

2.13 POST HYDRANTS

A. Nonfreeze, Draining-Type Post Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg Co; a division of Morris Group International.
 - b. MIFAB, Inc.
 - c. WATTS.
 - d. Woodford Manufacturing Company.
 - e. Zurn Industries, LLC.
2. Standard: ASME A112.21.3M.
3. Type: Nonfreeze, exposed-outlet post hydrant.
4. Operation: Loose key.
5. Casing and Operating Rod: Of at least length required for burial of valve below frost line.
6. Casing: Bronze with casing guard.
7. Inlet: NPS 3/4.
8. Outlet: Garden-hose thread complying with ASME B1.20.7.
9. Drain: Designed with hole to drain into ground when shut off.
10. Vacuum Breaker:
 - a. Nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
 - b. Garden-hose thread complying with ASME B1.20.7 on outlet.
11. Operating Key(s): Two with each loose-key-operation wall hydrant.

2.14 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Jay R. Smith Mfg Co; a division of Morris Group International.
 - c. Josam Company.
 - d. MIFAB, Inc.
 - e. Sioux Chief Manufacturing Company, Inc.
 - f. WATTS.
 - g. Zurn Industries, LLC.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows or Piston.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.15 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg Co; a division of Morris Group International.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. Sioux Chief Manufacturing Company, Inc.
 - e. WATTS.
 - f. Zurn Industries, LLC.
2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Drainage-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg Co; a division of Morris Group International.
 - b. MIFAB, Inc.
 - c. Precision Plumbing Products.
 - d. Zurn Industries, LLC.
2. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
3. Size: NPS 1-1/4 minimum.
4. Material: Chrome-plated, cast brass.

2.16 FLEXIBLE CONNECTORS

A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

B. Stainless Steel-Hose Flexible Connectors: Corrugated-stainless steel tubing with stainless steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

2.17 WATER METERS

A. Displacement-Type Water Meters:

1. Standard: AWWA C700.
2. Pressure Rating: 150-psig working pressure.
3. Body Design: Nutating disc; totalization meter.
4. Registration: In gallons or cubic feet as required by utility company.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Remote Registration System: Encoder type complying with AWWA C707; modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company.
 - 1) System shall be capable of transmitting data using AMR/AMI technology.
5. Case: Bronze.
6. End Connections: Threaded or flanged.
- B. Turbine-Type Water Meters:
 1. Standard: AWWA C701.
 2. Pressure Rating: 150 psig working pressure.
 3. Body Design: Turbine; totalization meter.
 4. Registration: In gallons or cubic feet as required by utility company.
 - a. Remote Registration System: Encoder type complying with AWWA C707; modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company.
 - 1) System shall be capable of transmitting data using AMR/AMI technology.
 5. Case: Bronze.
 6. End Connections: Threaded or flanged.
- C. Compound-Type Water Meters:
 1. Standard: AWWA C702.
 2. Pressure Rating: 150-psig working pressure.
 3. Body Design: With integral mainline and bypass meters; totalization meter.
 4. Registration: In gallons or cubic feet as required by utility company.
 - a. Remote Registration System: Encoder type complying with AWWA C707; modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company.
 - 1) System shall be capable of transmitting data using AMR/AMI technology.
 5. Case: Bronze.
 6. End Connections: Flanged.
- D. Ultrasonic-Type Water Meters:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Badger Meter, Inc.
 - b. Master Meter, Inc.
 - c. Neptune Technology Group Inc.
 2. Standard: Applicable portions of AWWA C700.
 3. Pressure Rating: 150 psig working pressure.
 4. Body Design: Ultrasonic open flow tube; totalization meter.
 5. Registration: In gallons or cubic feet as required by utility company.
 - a. Remote Registration System: Encoder type complying with AWWA C707; modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company.
 - 1) System shall be capable of transmitting data using AMR/AMI technology.
 6. Case: Bronze.
 7. End Connections: Threaded or flanged.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

- A. Backflow Preventers: Install in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 - 1. Locate backflow preventers in same room as connected equipment or system.
 - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
 - 3. Do not install bypass piping around backflow preventers.
- B. Water Regulators: Install with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gauges on inlet and outlet.
- C. Water Control Valves: Install with inlet and outlet shutoff valves and bypass with globe valve. Install pressure gauges on inlet and outlet.
- D. Automatic Water Shutoff Valves: Test for signal strength before valve installation. Install automatic shutoff valve downstream from main domestic water shutoff valve. Install valve controller in an accessible location with sensors in areas where water is likely to accumulate.
- E. Balancing Valves: Install in locations where they can easily be adjusted. Set at indicated design flow rates.
- F. Temperature-Actuated, Water Mixing Valves: Install with check stops or shutoff valves on inlets and with shutoff valve on outlet.
 - 1. Install cabinet-type units recessed in or surface mounted on wall as specified.
- G. Y-Pattern Strainers: For water, install on supply side of each control valve] water pressure-reducing valve, solenoid valve, and pump.
- H. Outlet Boxes: Install boxes recessed in wall or surface mounted on wall. Install 1-1/2-by-3-1/2-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 06 10 00 "Rough Carpentry."
- I. Hose Stations: Install with check stops or shutoff valves on inlets and with thermometer on outlet.
 - 1. Install cabinet-type units recessed in or surface mounted on wall as specified. Install 1-1/2-by-3-1/2-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 06 10 00 "Rough Carpentry."
- J. Ground Hydrants: Install with 1 cu. yd. of crushed gravel around drain hole. Set ground hydrants with box flush with grade.
- K. Nonfreeze, Draining-Type Post Hydrants: Install with 1 cu. yd. of crushed gravel around drain hole. Set post hydrants in concrete paving or in 1 cu. ft. of concrete block at grade.
- L. Nonfreeze, Nondraining-Type Post Hydrants: Set in concrete or pavement.
- M. Nonfreeze, Sanitary Yard Hydrants: Set with riser pipe in concrete or pavement. Do not encase canister in concrete.
- N. Nonfreeze, Draining-Type Roof Hydrants: Install with drain connection piped to nearest floor drain or to the exterior.
- O. Water-Hammer Arresters: Install in water piping in accordance with PDI-WH 201.
- P. Supply-Type, Trap-Seal Primer Device: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- Q. Drainage-Type, Trap-Seal Primer Device: Install as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- R. Trap-Seal Primer Systems: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.
- 3.2 PIPING CONNECTIONS
- A. Drawings indicate general arrangement of piping, fittings, and specialties.
 - B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.
- 3.3 ELECTRICAL CONNECTIONS
- A. Connect wiring in accordance with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
 - B. Ground equipment in accordance with Section 26 05 26 "Grounding and Bonding for Electrical Systems."
 - C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.
- 3.4 CONTROL CONNECTIONS
- A. Connect control wiring in accordance with Section 26 05 23 "Control-Voltage Electrical Power Cables."
- 3.5 IDENTIFICATION
- A. Plastic Labels for Equipment: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Vacuum breakers.
 - 2. Backflow preventers.
 - 3. Water pressure-reducing valves.
 - 4. Automatic water shutoff valve systems.
 - 5. Balancing valves.
 - 6. Temperature-actuated, water mixing valves.
 - 7. Outlet boxes.
 - 8. Hose stations.
 - 9. Wall hydrants.
 - 10. Ground hydrants.
 - 11. Post hydrants.
 - 12. Roof hydrants.
 - 13. Trap-seal primer device.
 - 14. Trap-seal primer systems.
 - 15. Water meters.
 - B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."
- 3.6 ADJUSTING
- A. Set field-adjustable pressure set points of water pressure-reducing valves.
 - B. Set field-adjustable flow set points of balancing valves.
 - C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.
 - D. Adjust each pressure vacuum breaker, reduced-pressure-principle backflow preventer, double-check, backflow-prevention assembly and double-check, detector-assembly backflow preventer in accordance with manufacturer's written instructions, authorities having jurisdiction and the device's reference standard.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections.
 - 1. Test each pressure vacuum breaker, reduced-pressure-principle backflow preventer, double-check, backflow-prevention assembly and double-check, detector-assembly backflow preventer according to authorities having jurisdiction and the device's reference standard.
 - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION

SECTION 22 11 23 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipes, tubes, and fittings.
 - 2. Piping specialties.
 - 3. Piping and tubing joining materials.
 - 4. Manual gas shutoff valves.
 - 5. Motorized gas valves.
 - 6. Pressure regulators.
 - 7. Service meters.
 - 8. Dielectric fittings.

1.3 DEFINITIONS

- A. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Piping specialties.
 - 2. Corrugated, stainless-steel tubing with associated components.
 - 3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
 - 4. Pressure regulators. Indicate pressure ratings and capacities.
 - 5. Service meters. Indicate pressure ratings and capacities. Include bypass fittings and meter bars supports.
 - 6. Dielectric fittings.
- B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
 - 1. Shop Drawing Scale: 1/4 inch per foot.
 - 2. Detail mounting, supports, and valve arrangements for pressure regulator assembly.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.
- B. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.
- C. Qualification Data: For qualified professional engineer.
- D. Welding certificates.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- E. Field quality-control reports.
- 1.6 CLOSEOUT SUBMITTALS
 - A. Operation and Maintenance Data: For pressure regulators and service meters to include in emergency, operation, and maintenance manuals.
- 1.7 QUALITY ASSURANCE
 - A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
 - C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- 1.8 DELIVERY, STORAGE, AND HANDLING
 - A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.
 - B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
 - C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.
 - D. Protect stored PE pipes and valves from direct sunlight.
- 1.9 PROJECT CONDITIONS
 - A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.
 - B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:
 - 1. Notify Owner no fewer than two days in advance of proposed interruption of natural-gas service.
 - 2. Do not proceed with interruption of natural-gas service without Owner's written permission.
- 1.10 COORDINATION
 - A. Coordinate sizes and locations of concrete bases with actual equipment provided.
 - B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Section 08 31 13 "Access Doors and Frames."

PART 2 - PRODUCTS

- 2.1 PERFORMANCE REQUIREMENTS
 - A. Minimum Operating-Pressure Ratings:
 - 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
 - 2. Service Regulators: 100 psig minimum unless otherwise indicated.
 - 3. Minimum Operating Pressure of Service Meter: 65 psig.
 - B. Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig but not more than 2 psig, and is reduced to secondary pressure of 0.5 psig or less.
- 2.2 PIPES, TUBES, AND FITTINGS
 - A. Steel Pipe: ASTM A53/A53M, black steel, Schedule 40, Type E or S, Grade B.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - 2. Wrought-Steel Welding Fittings: ASTM A234/A234M for butt welding and socket welding.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - a. Material Group: 1.1.
 - b. End Connections: Threaded or butt welding to match pipe.
 - c. Lapped Face: Not permitted underground.
 - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
 5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
 - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
 6. Mechanical Couplings:
 - a. Stainless-steel flanges and tube with epoxy finish.
 - b. Buna-nitrile seals.
 - c. Stainless-steel bolts, washers, and nuts.
 - d. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
 - e. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.
- B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.
1. Tubing: ASTM A240/A240M, corrugated, Series 300 stainless steel.
 2. Coating: PE with flame retardant.
 - a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1) Flame-Spread Index: 25 or less.
 - 2) Smoke-Developed Index: 50 or less.
 3. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
 4. Striker Plates: Steel, designed to protect tubing from penetrations.
 5. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
 6. Operating-Pressure Rating: 5 psig.
- C. Drawn-Temper Copper Tube: Comply with ASTM B88, Type K.
1. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.
 2. Bronze Flanges and Flanged Fittings: ASME B16.24, Class 150.
 - a. Gasket Material: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - b. Bolts and Nuts: ASME B18.2.1, carbon steel or stainless steel.
 3. Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch thick.
- D. Annealed-Temper Copper Tube: Comply with ASTM B88, Type K.
1. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Flare Fittings: Comply with ASME B16.26 and SAE J513.
 - a. Copper fittings with long nuts.
 - b. Metal-to-metal compression seal without gasket.
 - c. Dryseal threads complying with ASME B1.20.3.
 3. Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch thick.
- E. Tin-Lined Copper Tube: ASTM B280, seamless, annealed, with interior tin-plated lining.
1. Flare Fittings: Comply with ASME B16.26 and SAE J513.
 - a. Copper fittings with long nuts.
 - b. Metal-to-metal compression seal without gasket.
 - c. Dryseal threads complying with ASME B1.20.3.
- F. PE Pipe: ASTM D2513, SDR 11.
1. PE Fittings: ASTM D2683, socket-fusion type or ASTM D3261, butt-fusion type with dimensions matching PE pipe.
 2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D2513, SDR 11; and steel pipe complying with ASTM A53/A53M, black steel, Schedule 40, Type E or S, Grade B.
 3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
 - a. Underground Portion: PE pipe complying with ASTM D2513, SDR 11 inlet.
 - b. Casing: Steel pipe complying with ASTM A53/A53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.
 - c. Aboveground Portion: PE transition fitting.
 - d. Outlet shall be threaded or flanged or suitable for welded connection.
 - e. Tracer wire connection.
 - f. Ultraviolet shield.
 - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
 4. Transition Service-Line Risers: Factory fabricated and leak tested.
 - a. Underground Portion: PE pipe complying with ASTM D2513, SDR 11 inlet connected to steel pipe complying with ASTM A53/A53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
 - b. Outlet shall be threaded or flanged or suitable for welded connection.
 - c. Bridging sleeve over mechanical coupling.
 - d. Factory-connected anode.
 - e. Tracer wire connection.
 - f. Ultraviolet shield.
 - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
 5. Plastic Mechanical Couplings, NPS 1-1/2 and Smaller: Capable of joining PE pipe to PE pipe.
 - a. PE body with molded-in, stainless-steel support ring.
 - b. Buna-nitrile seals.
 - c. Acetal collets.
 - d. Electro-zinc-plated steel stiffener.
 6. Plastic Mechanical Couplings, NPS 2 and Larger: Capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
 - a. Fiber-reinforced plastic body.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- b. PE body tube.
 - c. Buna-nitrile seals.
 - d. Acetal collets.
 - e. Stainless-steel bolts, nuts, and washers.
7. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
- a. Stainless-steel flanges and tube with epoxy finish.
 - b. Buna-nitrile seals.
 - c. Stainless-steel bolts, washers, and nuts.
 - d. Factory-installed anode for steel-body couplings installed underground.

2.3 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig.
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

C. Y-Pattern Strainers:

1. Body: ASTM A126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

D. Basket Strainers:

1. Body: ASTM A126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

E. T-Pattern Strainers:

1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
 4. CWP Rating: 750 psig.
- F. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.
- 2.4 JOINING MATERIALS
- A. Joint Compound and Tape: Suitable for natural gas.
 - B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
 - C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.
- 2.5 MANUAL GAS SHUTOFF VALVES
- A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
 - B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
 1. CWP Rating: 125 psig.
 2. Threaded Ends: Comply with ASME B1.20.1.
 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
 4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
 6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
 - C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.
 1. CWP Rating: 125 psig.
 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
 3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 4. Service Mark: Initials "WOG" shall be permanently marked on valve body.
 - D. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.
 1. Ball: Chrome-plated brass.
 2. Stem: Bronze; blowout proof.
 3. Seats: Reinforced TFE; blowout proof.
 4. Packing: Separate packnut with adjustable-stem packing threaded ends.
 5. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 6. CWP Rating: 600 psig.
 7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
 - E. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
 1. Ball: Chrome-plated bronze.
 2. Stem: Bronze; blowout proof.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Seats: Reinforced TFE; blowout proof.
 4. Packing: Threaded-body packnut design with adjustable-stem packing.
 5. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 6. CWP Rating: 600 psig.
 7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- F. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. Body: Bronze, complying with ASTM B584.
 2. Ball: Chrome-plated bronze.
 3. Stem: Bronze; blowout proof.
 4. Seats: Reinforced TFE.
 5. Packing: Threaded-body packnut design with adjustable-stem packing.
 6. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 7. CWP Rating: 600 psig.
 8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- G. Bronze Plug Valves: MSS SP-78.
1. Body: Bronze, complying with ASTM B584.
 2. Plug: Bronze.
 3. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 4. Operator: Square head or lug type with tamperproof feature where indicated.
 5. Pressure Class: 125 psig.
 6. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 7. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- H. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.
1. Body: Cast iron, complying with ASTM A126, Class B.
 2. Plug: Bronze or nickel-plated cast iron.
 3. Seat: Coated with thermoplastic.
 4. Stem Seal: Compatible with natural gas.
 5. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 6. Operator: Square head or lug type with tamperproof feature where indicated.
 7. Pressure Class: 125 psig.
 8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- I. Cast-Iron, Lubricated Plug Valves: MSS SP-78.
1. Body: Cast iron, complying with ASTM A126, Class B.
 2. Plug: Bronze or nickel-plated cast iron.
 3. Seat: Coated with thermoplastic.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

4. Stem Seal: Compatible with natural gas.
5. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
6. Operator: Square head or lug type with tamperproof feature where indicated.
7. Pressure Class: 125 psig.
8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

J. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.6 MOTORIZED GAS VALVES

A. Automatic Gas Valves: Comply with ANSI Z21.21.

1. Body: Brass or aluminum.
2. Seats and Disc: Nitrile rubber.
3. Springs and Valve Trim: Stainless steel.
4. Normally closed.
5. Visual position indicator.
6. Electrical operator for actuation by appliance automatic shutoff device.

B. Electrically Operated Valves: Comply with UL 429.

1. Pilot operated.
2. Body: Brass or aluminum.
3. Seats and Disc: Nitrile rubber.
4. Springs and Valve Trim: Stainless steel.
5. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
6. NEMA ICS 6, Type 4, coil enclosure.
7. Normally closed.
8. Visual position indicator.

2.7 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Service Pressure Regulators: Comply with ANSI Z21.80.

1. Body and Diaphragm Case: Cast iron or die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

5. Orifice: Aluminum; interchangeable.
 6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
 8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
 9. Overpressure Protection Device: Factory mounted on pressure regulator.
 10. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
 11. Maximum Inlet Pressure: 100 psig.
- C. Line Pressure Regulators: Comply with ANSI Z21.80.
1. Body and Diaphragm Case: Cast iron or die-cast aluminum.
 2. Springs: Zinc-plated steel; interchangeable.
 3. Diaphragm Plate: Zinc-plated steel.
 4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
 5. Orifice: Aluminum; interchangeable.
 6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
 8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
 9. Overpressure Protection Device: Factory mounted on pressure regulator.
 10. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
 11. Maximum Inlet Pressure: 10 psig.
- D. Appliance Pressure Regulators: Comply with ANSI Z21.18.
1. Body and Diaphragm Case: Die-cast aluminum.
 2. Springs: Zinc-plated steel; interchangeable.
 3. Diaphragm Plate: Zinc-plated steel.
 4. Seat Disc: Nitrile rubber.
 5. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 6. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
 7. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
 8. Maximum Inlet Pressure: 5 psig.
- 2.8 DIELECTRIC FITTINGS
- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
1. Description:
 - a. Standard: ASSE 1079.
 - b. Pressure Rating: 125 psig minimum at 180 deg F.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
1. Description:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Standard: ASSE 1079.
 - b. Factory-fabricated, bolted, companion-flange assembly.
 - c. Pressure Rating: 125 psig minimum at 180 deg F.
 - d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:
- 1. Description:
 - a. Nonconducting materials for field assembly of companion flanges.
 - b. Pressure Rating: 150 psig.
 - c. Gasket: Neoprene or phenolic.
 - d. Bolt Sleeves: Phenolic or polyethylene.
 - e. Washers: Phenolic with steel backing washers.
- 2.9 LABELING AND IDENTIFYING
- A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to NFPA 54 to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with NFPA 54 requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Section 31 20 00 "Earth Moving" for excavating, trenching, and backfilling.
 - 1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.
- C. Install underground, PE, natural-gas piping according to ASTM D2774.
- D. Steel Piping with Protective Coating:
 - 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
 - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
 - 3. Replace pipe having damaged PE coating with new pipe.
- E. Copper Tubing with Protective Coating:
 - 1. Apply joint cover kits over tubing to cover, seal, and protect joints.
 - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
- F. Install fittings for changes in direction and branch connections.
- G. Install pressure gage downstream from each service regulator.

3.4 INDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Verify final equipment locations for roughing-in.
- L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.
 - 1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
 - 2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
 - 3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
 - 4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
 - a. Exception: Tubing passing through partitions or walls does not require striker barriers.
 - 5. Prohibited Locations:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
 - b. Do not install natural-gas piping in solid walls or partitions.
- Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
 - R. Connect branch piping from top or side of horizontal piping.
 - S. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
 - T. Do not use natural-gas piping as grounding electrode.
 - U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
 - V. Install pressure gage downstream from each line regulator.
 - W. Install sleeves for piping penetrations of walls, ceilings, and floors.
 - X. Install sleeve seals for piping penetrations of concrete walls and slabs.
 - Y. Install escutcheons for piping penetrations of walls, ceilings, and floors.
- 3.5 SERVICE-METER ASSEMBLY INSTALLATION
- A. Install service-meter assemblies aboveground, on concrete bases.
 - B. Install metal shutoff valves upstream from service regulators. Shutoff valves are not required at second regulators if two regulators are installed in series.
 - C. Install strainer on inlet of service-pressure regulator and meter set.
 - D. Install service regulators mounted outside with vent outlet horizontal or facing down. Install screen in vent outlet if not integral with service regulator.
 - E. Install metal shutoff valves upstream from service meters. Install dielectric fittings downstream from service meters.
 - F. Install service meters downstream from pressure regulators.
 - G. Install metal bollards to protect meter assemblies. Comply with requirements in Section 05 50 00 "Metal Fabrications" for pipe bollards.
- 3.6 VALVE INSTALLATION
- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.
 - B. Install underground valves with valve boxes.
 - C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
 - D. Install earthquake valves aboveground outside buildings according to listing.
 - E. Install anode for metallic valves in underground PE piping.
- 3.7 PIPING JOINT CONSTRUCTION
- A. Ream ends of pipes and tubes and remove burrs.
 - B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 - C. Threaded Joints:
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
 - D. Welded Joints:
 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
 2. Bevel plain ends of steel pipe.
 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
 - E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
 - F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.
 - G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.
 - H. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D2657.
 1. Plain-End Pipe and Fittings: Use butt fusion.
 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- 3.8 HANGER AND SUPPORT INSTALLATION
- A. Comply with requirements for seismic-restraint devices specified.
 - B. Comply with requirements for pipe hangers and supports specified.
 - C. Install hangers for steel piping and copper tubing, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
 - D. Install hangers for corrugated stainless-steel tubing, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
 - E. Support horizontal piping within 12 inches of each fitting.
 - F. Support vertical runs of steel piping and copper tubing to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
 - G. Support vertical runs of corrugated stainless-steel tubing to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- 3.9 CONNECTIONS
- A. Connect to utility's gas main according to utility's procedures and requirements.
 - B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
 - C. Install piping adjacent to appliances to allow service and maintenance of appliances.
 - D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
 - E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.
- 3.10 LABELING AND IDENTIFYING
- A. Comply with requirements in specifications and plans for piping and valve identification.
 - B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3.11 PAINTING

- A. Comply with requirements in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting" for painting interior and exterior natural-gas piping.
- B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
 - 1. Alkyd System: MPI EXT 5.1D.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Exterior alkyd enamel (flat).
 - d. Color: Gray.
- C. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
 - 1. Latex Over Alkyd Primer System: MPI INT 5.1Q.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Topcoat: Interior latex (flat).
 - c. Color: Gray.
 - 2. Alkyd System: MPI INT 5.1E.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Interior alkyd matching topcoat.
 - c. Topcoat: Interior alkyd (flat).
 - d. Color: Gray.
- D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.12 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Use 3000-psi, 28-day, compressive-strength concrete and reinforcement as specified in Section 03 30 00 "Cast-in-Place Concrete."

3.13 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.
- C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3.14 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.15 OUTDOOR PIPING SCHEDULE

- A. Underground natural-gas piping shall be:
 - 1. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.
- B. Aboveground natural-gas piping shall be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with wrought-steel fittings and welded joints.
 - 3. Annealed-temper copper tube with wrought-copper fittings and brazed joints.
- C. Branch Piping in Cast-in-Place Concrete to Single Appliance: Annealed-temper copper tube with wrought-copper fittings and brazed joints. Install piping embedded in concrete with no joints in concrete.
- D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.16 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

- A. Aboveground, branch piping NPS 1 and smaller shall be the following:
 - 1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
 - 2. Annealed-temper, tin-lined copper tube with flared joints and fittings.
 - 3. Annealed-temper, copper tube with wrought-copper fittings and brazed joints.
 - 4. Aluminum tube with flared fittings and joints.
 - 5. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping shall be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with wrought-steel fittings and welded joints.
 - 3. Drawn-temper copper tube with wrought-copper fittings and brazed joints.
- C. Underground, below building, piping shall be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with wrought-steel fittings and welded joints.
- D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.17 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG AND LESS THAN 5 PSIG

- A. Aboveground, branch piping NPS 1 and smaller shall be one of the following:
 - 1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
 - 2. Annealed-temper, tin-lined copper tube with flared joints and fittings.
 - 3. Annealed-temper, copper tube with wrought-copper fittings and brazed joints.
 - 4. Aluminum tube with flared fittings and joints.
 - 5. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping shall be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Steel pipe with steel welding fittings and welded joints.
 3. Drawn-temper copper tube with wrought-copper fittings and brazed joints.
- C. Underground, below building, piping shall be one of the following:
1. Steel pipe with malleable-iron fittings and threaded joints.
 2. Steel pipe with wrought-steel fittings and welded joints.
- D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat underground pipe and fittings with protective coating for steel piping.
- E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.
- 3.18 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 5 PSIG
- A. Aboveground Piping: Maximum operating pressure more than 5 psig.
- B. Aboveground, Branch Piping: Steel pipe with steel welding fittings and welded joints.
- C. Aboveground, distribution piping shall be one of the following:
1. Steel pipe with steel welding fittings and welded joints.
 2. Drawn-temper copper tube with wrought-copper fittings and brazed joints.
- D. Underground, below building, piping shall be one of the following:
1. Steel pipe with malleable-iron fittings and threaded joints.
 2. Steel pipe with wrought-steel fittings and welded joints.
- E. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- F. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.
- 3.19 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE
- A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.
- B. Underground:
1. PE valves.
 2. NPS 2 and Smaller: Bronze plug valves.
 3. NPS 2-1/2 and Larger: Cast-iron, nonlubricated plug valves.
- 3.20 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE
- A. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following:
1. One-piece, bronze ball valve with bronze trim.
 2. Bronze plug valve.
- B. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be one of the following:
1. Bronze plug valve.
 2. Cast-iron, nonlubricated plug valve.
- C. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:
1. One-piece, bronze ball valve with bronze trim.
 2. Bronze plug valve.
- D. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be one of the following:
1. Bronze plug valve.
 2. Cast-iron, lubricated plug valve.
- E. Valves in branch piping for single appliance shall be one of the following:
1. One-piece, bronze ball valve with bronze trim.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Bronze plug valve.

END OF SECTION

SECTION 22 11 23.21 - INLINE, DOMESTIC-WATER PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. In-line, sealless centrifugal pumps.
 - 2. Horizontally mounted, in-line, separately coupled centrifugal pumps.
 - 3. Horizontally mounted, in-line, close-coupled centrifugal pumps.
 - 4. Vertically mounted, in-line, close-coupled centrifugal pumps.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include construction materials, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Sustainable Design Submittals:
 - 1. Product Data: For pump controls.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Detail pumps and adjacent equipment. Show support locations, type of support, weight on each support, required clearances, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Structural members to which pumps will be attached.
 - 2. Size and location of initial access modules for acoustical tile.
- B. Seismic Qualification Data: Certificates, for inline, domestic-water pumps, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For inline, domestic-water pumps to include in operation and maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.
- C. Comply with pump manufacturer's written instructions for handling.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. UL Compliance: UL 778 for motor-operated water pumps.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- C. Drinking Water System Components - Health Effects and Drinking Water System Components - Lead Content Compliance: NSF 61 and NSF 372.
 - D. Seismic Performance: Inline, domestic-water pumps shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified."
 - 2. Component Importance Factor: 1.0.
- 2.2 IN-LINE, SEALLESS CENTRIFUGAL PUMPS
- A. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps.
 - B. Pump Construction:
 - 1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
 - 2. Minimum Working Pressure: 125 psig.
 - 3. Maximum Continuous Operating Temperature: 220 deg F.
 - 4. Casing: Bronze, with threaded or companion-flange connections.
 - 5. Impeller: stainless steel.
 - 6. Motor: Single speed.
- 2.3 HORIZONTALLY MOUNTED, IN-LINE, SEPARATELY COUPLED CENTRIFUGAL PUMPS
- A. Description: Factory-assembled and -tested, in-line, single-stage, separately coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shafts mounted horizontal.
 - B. Pump Construction:
 - 1. Casing:
 - a. Radially split bronze with threaded companion-flange connections for pumps with NPS 2 pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections.
 - b. Built to permit servicing of pump internals without disturbing the casing or the suction and discharge piping.
 - c. Gauge port tapings at suction and discharge nozzles.
 - 2. Impeller: Bronze or stainless steel, statically and dynamically balanced, closed, and keyed to shaft.
 - 3. Shaft and Shaft Sleeve: Steel shaft, with copper-alloy shaft sleeve.
 - 4. Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
 - 5. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket.
 - 6. Bearings: permanently lubricated ball type.
 - 7. Minimum Working Pressure: 175 psig.
 - 8. Continuous Operating Temperature: 200 deg F.
 - C. Motor: Single speed, with permanently lubricated ball bearings; and resiliently or rigidly mounted to pump casing.
- 2.4 HORIZONTALLY MOUNTED, IN-LINE, CLOSE-COUPLED CENTRIFUGAL PUMPS
- A. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shaft mounted horizontal.
 - B. Pump Construction:
 - 1. Casing:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Radially split bronze brass or cast iron with threaded companion-flange connections for pumps with NPS 2 pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections.
 - b. Built to permit servicing of pump internals without disturbing the casing or the suction and discharge piping.
 - c. Gauge port tapings at suction and discharge nozzles.
2. Impeller: Bronze or brass, statically and dynamically balanced, closed, and keyed to shaft.
 3. Shaft and Shaft Sleeve: Steel shaft with deflector, with copper-alloy shaft sleeve. Include water slinger on shaft between motor and seal.
 4. Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
 5. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket.
 6. Bearings: permanently lubricated ball type.
 7. Minimum Working Pressure: 175 psig.
 8. Continuous Operating Temperature: 225 deg F.
- C. Motor: Single speed, with grease-lubricated ball bearings; resiliently or rigidly mounted to pump casing.
- 2.5 VERTICALLY MOUNTED, IN-LINE, CLOSE-COUPLED CENTRIFUGAL PUMPS
- A. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shaft mounted vertical.
- B. Pump Construction:
1. Casing: Radially split bronze cast or ductile iron, with wear rings and threaded companion-flange connections for pumps with NPS 2 pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections. Include pump manufacturer's base attachment for mounting pump on concrete base.
 2. Impeller: Bronze brass or stainless steel, statically and dynamically balanced, closed, and keyed to shaft.
 3. Shaft and Shaft Sleeve: Steel or stainless-steel shaft, with copper-alloy shaft sleeve.
 4. Shaft Coupling: Flexible or rigid type if pump is provided with coupling.
 5. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket. Include water slinger on shaft between motor and seal.
 6. Bearings: Oil-lubricated; bronze-journal or ball type.
 7. Minimum Working Pressure: 175 psig.
 8. Continuous Operating Temperature: 225 deg F.
- C. Motor: Single speed, with grease-lubricated ball bearings; rigidly mounted to pump casing.
- 2.6 MOTORS
- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 22 05 13 "Common Motor Requirements for Plumbing Equipment."
1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for domestic-water-piping system to verify actual locations of piping connections before pump installation.

3.2 PUMP INSTALLATION

- A. Mount pumps in orientation complying with manufacturer's written instructions.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. Install thermostats in hot-water return piping.

3.3 PIPING CONNECTIONS

- A. Comply with requirements for piping specified in Section 22 11 16 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to inline, domestic-water pumps, allow space for service and maintenance.
- C. Connect domestic-water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.
 - 1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:
 - a. Horizontally mounted, in-line, separately coupled centrifugal pumps.
 - b. Horizontally mounted, in-line, close-coupled centrifugal pumps.
 - c. Vertically mounted, in-line, close-coupled centrifugal pumps.
 - d. Comply with requirements for flexible connectors specified in Section 22 11 16 "Domestic Water Piping."
- D. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for strainers specified in Section 22 11 19 "Domestic Water Piping Specialties." Comply with requirements for valves specified in the following:
 - 1. Section 22 05 23.12 "Ball Valves for Plumbing Piping."
 - 2. Section 22 05 23.13 "Butterfly Valves for Plumbing Piping."
 - 3. Section 22 05 23.14 "Check Valves for Plumbing Piping."
 - 4. Section 22 05 23.15 "Gate Valves for Plumbing Piping."
 - 5. Install pressure gauge and snubber at suction of each pump and pressure gauge and snubber at discharge of each pump. Install at integral pressure-gauge tapings where provided or install pressure-gauge connectors in suction and discharge piping around pumps. Comply with requirements for pressure gauges and snubbers specified in Section 22 05 19 "Meters and Gages for Plumbing Piping."

3.4 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring between temperature controllers and devices.
- C. Interlock pump between water heater and hot-water storage tank with water heater burner and time-delay relay.

3.5 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment" for identification of pumps.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Perform tests and inspections.
- E. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - F. Inline, domestic-water pump will be considered defective if it does not pass tests and inspections.
 - G. Prepare test and inspection reports.
- 3.7 STARTUP SERVICE
- A. Perform startup service.
 1. Complete installation and startup checks according to manufacturer's written instructions.
 2. Check piping connections for tightness.
 3. Clean strainers on suction piping.
 4. Set thermostats, for automatic starting and stopping operation of pumps.
 5. Perform the following startup checks for each pump before starting:
 - a. Verify bearing lubrication.
 - b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
 - c. Verify that pump is rotating in the correct direction.
 6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
 7. Start motor.
 8. Open discharge valve slowly.
 9. Adjust temperature settings on thermostats.
 10. Adjust timer settings.
- 3.8 ADJUSTING
- A. Adjust inline, domestic-water pumps to function smoothly, and lubricate as recommended by manufacturer.
 - B. Adjust initial temperature set points.
 - C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION

SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Hub-and-spigot, cast-iron soil pipe and fittings.
2. Hubless, cast-iron soil pipe and fittings.
3. Ductile-iron pipe and fittings.
4. Copper tube and fittings.
5. PVC pipe and fittings.
6. Specialty pipe fittings.
7. Encasement for underground metal piping.

B. Related Requirements:

1. Section 22 13 13 "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

- C. Shop Drawings: For hubless, single-stack drainage system. Include plans, elevations, sections, and details.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 FIELD CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

1.6 WARRANTY

- A. Listed manufacturers to provide labeling and warranty of their respective products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

2.2 PIPING MATERIALS

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- 2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS
- A. Pipe and Fittings: ASTM A 74, Service and Extra Heavy class(es).
 - B. Gaskets: ASTM C 564, rubber.
 - C. Caulking Materials: ASTM B 29, pure lead and oakum or hemp fiber.
- 2.4 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS
- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
 - B. CISPI, Hubless-Piping Couplings:
 - 1. Standards: ASTM C 1277 and CISPI 310.
 - 2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
 - C. Heavy-Duty, Hubless-Piping Couplings:
 - 1. Standards: ASTM C 1277 and ASTM C 1540.
 - 2. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
 - D. Cast-Iron, Hubless-Piping Couplings:
 - 1. Standard: ASTM C 1277.
 - 2. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- 2.5 DUCTILE-IRON PIPE AND FITTINGS
- A. Ductile-Iron, Mechanical-Joint Piping:
 - 1. Ductile-Iron Pipe: AWWA C151/A21.51, with mechanical-joint bell and plain spigot ends unless grooved or flanged ends are indicated.
 - B. Ductile-Iron, Push-on-Joint Piping:
 - 1. Ductile-Iron Pipe: AWWA C151/A21.51, with push-on-joint bell and plain spigot ends unless grooved or flanged ends are indicated.
 - C. Ductile-Iron, Grooved-Joint Piping: AWWA C151/A21.51, with round-cut-grooved ends according to AWWA C606.
 - D. Ductile-Iron, Grooved-End Pipe Appurtenances:
 - 1. Grooved-End, Ductile-Iron Fittings: ASTM A 536 ductile-iron castings, with dimensions matching AWWA C110/A 21.10 ductile-iron pipe or AWWA C153/A 21.53 ductile-iron fittings, and complying with AWWA C606 for grooved ends.
 - 2. Grooved Mechanical Couplings for Ductile-Iron Pipe: ASTM F 1476, Type I. Include ferrous housing sections with continuous curved keys; EPDM-rubber center-leg gasket suitable for hot and cold water; and bolts and nuts.
- 2.6 COPPER TUBE AND FITTINGS
- A. Copper Type DWV Tube: ASTM B 306, drainage tube, drawn temper.
 - B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
 - C. Hard Copper Tube: ASTM B 88, Type L and Type M, water tube, drawn temper.
 - D. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.
 - E. Copper Pressure Fittings:
 - 1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- F. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.
- G. Solvent Cement: ASTM D 2235.
 - 1. Verify solvent cement has a VOC content of 325 g/L or less.
 - 2. Verify solvent cement complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.7 PVC PIPE AND FITTINGS

- A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.
- B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- D. Adhesive Primer: ASTM F 656.
 - 1. Verify adhesive primer complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- E. Solvent Cement: ASTM D 2564.
 - 1. Verify solvent cement has a VOC content of 510 g/L or less.

2.8 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
 - 1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
 - 2. Unshielded, Nonpressure Transition Couplings:
 - a. Standard: ASTM C 1173.
 - b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - c. End Connections: Same size as and compatible with pipes to be joined.
 - d. Sleeve Materials:
 - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
 - 3. Shielded, Nonpressure Transition Couplings:
 - a. Standard: ASTM C 1460.
 - b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - c. End Connections: Same size as and compatible with pipes to be joined.
 - 4. Pressure Transition Couplings:
 - a. Standard: AWWA C219.
 - b. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
 - c. Center-Sleeve Material: Manufacturer's standard.
 - d. Gasket Material: Natural or synthetic rubber.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- e. Metal Component Finish: Corrosion-resistant coating or material.
 - B. Dielectric Fittings:
 - 1. Dielectric Unions:
 - a. Description:
 - 1) Standard: ASSE 1079.
 - 2) Pressure Rating: 125 psig minimum at 180 deg F.
 - 3) End Connections: Solder-joint copper alloy and threaded ferrous.
 - 2. Dielectric Nipples:
 - a. Description:
 - 1) Standard: IAPMO PS 66.
 - 2) Electroplated steel nipple.
 - 3) Pressure Rating: 300 psig at 225 deg F.
 - 4) End Connections: Male threaded or grooved.
 - 5) Lining: Inert and noncorrosive, propylene.
- 2.9 ENCASEMENT FOR UNDERGROUND METAL PIPING
- A. Standard: ASTM A 674 or AWWA C105/A 21.5.
 - B. Material: Linear low-density polyethylene film of 0.008-inch or high-density, cross-laminated polyethylene film of 0.004-inch minimum thickness.
 - C. Form: Sheet or tube.
 - D. Color: Black or natural.

PART 3 - EXECUTION

3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 31 20 00 "Earth Moving."

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
 - 1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
 - 2. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Lay buried building waste piping beginning at low point of each system.
 - 1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
 3. Maintain swab in piping and pull past each joint as completed.
- K. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- L. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.
- M. Install steel piping according to applicable plumbing code.
- N. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- O. Install aboveground PVC piping according to ASTM D 2665.
- P. Install underground PVC piping according to ASTM D 2321.
- Q. Install engineered soil and waste and vent piping systems as follows:
1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
 2. Hubless, Single-Stack Drainage System: Comply with ASME B16.45 and hubless, single-stack aerator fitting manufacturer's written installation instructions.
 3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
 4. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.
- R. Plumbing Specialties:
1. Install backwater valves in sanitary waster gravity-flow piping.
 - a. Comply with requirements for backwater valves specified in Section 22 13 19 "Sanitary Waste Piping Specialties."
 2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
 - a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
 - b. Comply with requirements for cleanouts specified in Section 22 13 19 "Sanitary Waste Piping Specialties."
 3. Install drains in sanitary waste gravity-flow piping.
 - a. Comply with requirements for drains specified in Section 22 13 19 "Sanitary Waste Piping Specialties."
- S. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- T. Install sleeves for piping penetrations of walls, ceilings, and floors.
1. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- U. Install sleeve seals for piping penetrations of concrete walls and slabs.
1. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- V. Install escutcheons for piping penetrations of walls, ceilings, and floors.
1. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.
- C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.
 - 1. Cut threads full and clean using sharp dies.
 - 2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
 - c. Do not use pipe sections that have cracked or open welds.
- E. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- F. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.
- G. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
 - 1. Install transition couplings at joints of piping with small differences in ODs.
 - 2. In Waste Drainage Piping: Unshielded, nonpressure transition couplings.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for pipe hanger and support devices and installation specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 - 2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 - 3. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 4. Install individual, straight, horizontal piping runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - 5. Support pipe rolls on trapeze.
 - 6. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install hangers for cast-iron, steel and copper soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- C. Install hangers for PVC piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- D. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- E. Support vertical runs of cast iron, steel, stainless-steel and copper soil piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- F. Support vertical runs of PVC piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect waste and vent piping to the following:
 - 1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
 - 5. Comply with requirements for backwater valves, cleanouts and drains specified in Section 22 13 19 "Sanitary Waste Piping Specialties."
 - 6. Equipment: Connect waste piping as indicated.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.7 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping.
- B. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
 - a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.
 - a. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
 - b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
 - c. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.
- a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
 - b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
 - c. Air pressure must remain constant without introducing additional air throughout period of inspection.
 - d. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.
- E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.10 PIPING SCHEDULE

- A. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:
 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 2. Hubless, cast-iron soil pipe and fittings and hubless, single-stack aerator fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.
 3. Copper Type DWV tube, copper drainage fittings, and soldered joints.
 4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- B. Aboveground, soil and waste piping NPS 5 and larger shall be any of the following:
 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 2. Hubless, cast-iron soil pipe and fittings and hubless, single-stack aerator fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.
 3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- C. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.
 3. Copper Type DWV tube, copper drainage fittings, and soldered joints.
 - a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2: Hard copper tube, Type M; copper pressure fittings; and soldered joints.
 4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- D. Aboveground, vent piping NPS 5 and larger shall be any of the following:
 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.
 3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- E. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
1. Extra Heavy Service class, cast-iron soil piping; gaskets; and gasketed calking materials; and calked joints.
 2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty cast-iron hubless-piping couplings; and coupled joints.
 3. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- F. Underground, soil and waste piping NPS 5 and larger shall be any of the following:
1. Extra Heavy Service class, cast-iron soil piping; gaskets; and gasketed calking materials; and calked joints.
 2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty cast-iron hubless-piping couplings; coupled joints.
 3. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.

END OF SECTION

SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Backwater valves.
 - 2. Cleanouts.
 - 3. Air-admittance valves.
 - 4. Miscellaneous sanitary drainage piping specialties.
- B. Related Requirements:
 - 1. Section 22 13 23 "Sanitary Waste Interceptors" for metal and concrete interceptors outside the building, grease interceptors, grease-removal devices, oil interceptors, and solids interceptors.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile butadiene styrene.
- B. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Show fabrication and installation details for frost-resistant vent terminals.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For sanitary waste piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

- A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

2.2 CLEANOUTS

- A. Cast-Iron Exposed Cleanouts:
 - 1. Standard: ASME A112.36.2M.
 - 2. Size: Same as connected drainage piping
 - 3. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch, Hubless, cast-iron soil pipe test tee as required to match connected piping.
 - 4. Closure: Countersunk or raised-head, brass plug.
 - 5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- B. Stainless Steel Exposed Cleanouts:
 - 1. Standard: ASME A112.3.1.
 - 2. Size: Same as connected drainage piping.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Body Material: Stainless steel tee with side cleanout as required to match connected piping.
 4. Closure: Stainless steel plug with seal.
- C. Cast-Iron Exposed Floor Cleanouts:
1. Standard: ASME A112.36.2M for adjustable housing threaded, adjustable housing cleanout.
 2. Size: Same as connected branch.
 3. Type: Adjustable housing Threaded, adjustable housing.
 4. Body or Ferrule: Cast iron.
 5. Outlet Connection: Inside calk.
 6. Closure: Brass plug with straight threads and gasket.
 7. Adjustable Housing Material: ` Plastic with threads.
 8. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
 9. Frame and Cover Shape: Round.
 10. Top-Loading Classification: Extra Heavy Duty.
 11. Riser: ASTM A74, Extra-Heavy Service Class, cast-iron drainage pipe fitting and riser to cleanout.
- D. Stainless Steel Exposed Floor Cleanouts:
1. Standards: ASME A112.3.1; NSF listed.
 2. Size: Same as connected branch.
 3. Housing: Type 304 stainless steel.
 4. Closure: Stainless steel with seal.
 5. Riser: ASTM A74, Extra-Heavy Service Class, drainage pipe fitting and riser to cleanout.
 6. Body or Ferrule: Stainless steel.
 7. Outlet Connection: Inside caulk.
 8. Adjustable Housing Material: Cast iron or Plastic with threads.
 9. Frame and Cover Material and Finish: Stainless steel.
 10. Frame and Cover Shape: Round.
 11. Top-Loading Classification: Extra Heavy Light Medium Duty.
- E. Cast-Iron Wall Cleanouts Insert drawing designation, if any:
1. Standard: ASME A112.36.2M. Include wall access.
 2. Size: Same as connected drainage piping.
 3. Body: Hub-and-spigot, cast-iron soil pipe T-branch, Hubless, cast-iron soil pipe test tee as required to match connected piping.
 4. Closure Plug:
 - a. Brass.
 - b. Countersunk or raised head.
 - c. Drilled and threaded for cover attachment screw.
 - d. Size: Same as or not more than one size smaller than cleanout size.
 5. Wall Access, Cover Plate: Round, flat, chrome-plated brass or stainless steel cover plate with screw.
 6. Wall Access, Frame and Cover: Round, nickel-bronze, copper-alloy, or stainless steel wall-installation frame and cover.
- 2.3 AIR-ADMITTANCE VALVES
- A. Fixture Air-Admittance Valves:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Standard: ASSE 1051, Type A for single fixture or Type B for branch piping.
 2. Housing: Plastic.
 3. Operation: Mechanical sealing diaphragm.
 4. Size: Same as connected fixture or branch vent piping.
- B. Stack Air-Admittance Valves:
1. Standard: ASSE 1050 for vent stacks.
 2. Housing: Plastic.
 3. Operation: Mechanical sealing diaphragm.
 4. Size: Same as connected stack vent or vent stack.
- C. Wall Box for Air-Admittance Valves:
1. Description: White plastic housing with white plastic grille, made for recessed installation. Include bottom pipe connection and space to contain one air-admittance valve.
 2. Size: Approximately 6 inches wide by 6 inches high by 4 inches deep.
- 2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES
- A. Open Drains:
1. Description: Shop or field fabricate from ASTM A74, Service Class, hub-and-spigot, cast-iron soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C564 rubber gaskets.
 2. Size: Same as connected waste piping with increaser fitting of size indicated.
- B. Deep-Seal Traps:
1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
 2. Size: Same as connected waste piping.
 - a. NPS 2: 4-inch-minimum water seal.
 - b. NPS 2-1/2 and Larger: 5-inch-minimum water seal.
- C. Floor-Drain, Trap-Seal Primer Fittings Insert drawing designation, if any:
1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
 2. Size: Same as floor drain outlet with NPS 1/2 side inlet.
- D. Floor-Drain, Inline Trap Seal:
1. Description: Inline floor drain trap seal, forming a physical barrier to slow trap evaporation while not impeding flow from drain.
 2. Material: Polymer.
 3. Standard: Tested and certified in accordance with ASSE 1072.
 4. Listing: ICC-ES or IAPMO listed.
 5. Size: Same as floor drain outlet or strainer throat.
- E. Air-Gap Fittings:
1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
 2. Body: Bronze or cast iron.
 3. Inlet: Opening in top of body.
 4. Outlet: Larger than inlet.
 5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.
- F. Sleeve Flashing Device:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
 2. Size: As required for close fit to riser or stack piping.
- G. Stack Flashing Fittings:
1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
 2. Size: Same as connected stack vent or vent stack.
- H. Vent Caps:
1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
 2. Size: Same as connected stack vent or vent stack.
- I. Frost-Resistant Vent Terminals:
1. Description: Manufactured or shop-fabricated assembly constructed of copper, lead-coated copper, or galvanized steel.
 2. Design: To provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.
- J. Expansion Joints:
1. Standard: ASME A112.6.4.
 2. Body: Cast iron with bronze sleeve, packing, and gland.
 3. End Connections: Matching connected piping.
 4. Size: Same as connected soil, waste, or vent piping.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install backwater valves in building drain piping.
1. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.
 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 4. Locate at base of each vertical soil and waste stack.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install fixture air-admittance valves on fixture drain piping.
- F. Install stack air-admittance valves at top of stack vent and vent stack piping.
- G. Install air-admittance-valve wall boxes recessed in wall.
- H. Assemble open drain fittings and install with top of hub 1 inch above floor.
- I. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- J. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 2. Size: Same as floor drain inlet.
- K. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- L. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.
- M. Install wood-blocking reinforcement for wall-mounting-type specialties.
- N. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- 3.2 PIPING CONNECTIONS
- A. Comply with requirements in Section 22 13 16 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment, to allow service and maintenance.
- 3.3 LABELING AND IDENTIFYING
- A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.
1. Nameplates and signs are specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."
- 3.4 PROTECTION
- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 22 13 19.13 - SANITARY DRAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Floor drains.
 - 2. Floor sinks.
 - 3. Trench drains.
 - 4. Channel drainage systems.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene styrene.
- B. FRP: Fiberglass-reinforced plastic.
- C. HDPE: High-density polyethylene.
- D. PE: Polyethylene.
- E. PP: Polypropylene.
- F. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 DRAIN ASSEMBLIES

- A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary piping specialty components.

2.2 FLOOR DRAINS

- A. REFERENCE PLUMBING PLANS

2.3 FLOOR SINKS

- A. REFERENCE PLUMBING PLANS

2.4 TRENCH DRAINS

- A. REFERENCE PLUMBING PLANS

2.5 CHANNEL DRAINAGE SYSTEMS

- A. REFERENCE PLUMBING PLANS

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 1. Position floor drains for easy access and maintenance.
 - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
 - 3. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
 - 4. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.
 - a. Maintain integrity of waterproof membranes where penetrated.
 - 5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- B. Install trench drains at low points of surface areas to be drained.
 - 1. Set grates of drains flush with finished surface, unless otherwise indicated.
- C. Comply with ASME A112.3.1 for installation of stainless-steel channel drainage systems.
 - 1. Install on support devices, so that top will be flush with adjacent surface.
- D. Install FRP channel drainage system components on support devices, so that top will be flush with adjacent surface.
- E. Install plastic channel drainage system components on support devices, so that top will be flush with adjacent surface.
- F. Install open drain fittings with top of hub 2 inches above floor.

3.2 CONNECTIONS

- A. Comply with requirements in Section 22 13 16 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Comply with requirements in Section 22 13 19 "Sanitary Waste Piping Specialties" for backwater valves, air admittance devices and miscellaneous sanitary drainage piping specialties.
- C. Install piping adjacent to equipment to allow service and maintenance.

3.3 LABELING AND IDENTIFYING

- A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 22 34 00 - FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Commercial, power-burner, gas-fired, storage, domestic-water heaters.
2. Commercial, power-vent, gas-fired, storage, domestic-water heaters.
3. Commercial, direct-vent, gas-fired, storage, domestic-water heater.
4. Commercial, gas-fired, high-efficiency, storage, domestic-water heaters.
5. Commercial, coil-type, finned-tube, gas-fired, domestic-water heaters.
6. Commercial, grid-type, finned-tube, gas-fired, domestic-water heaters.
7. Gas-fired, tankless, domestic-water heaters.
8. Residential, direct-vent, gas-fired, storage, domestic-water heaters.
9. Residential, power-vent, gas-fired, storage, domestic-water heaters.
10. Commercial, gas- and oil-fired, domestic-water heaters.
11. Domestic-water heater accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Sustainable Design Submittals:
 1. Water Heaters: Product Data for water heater compliance with ASHRAE's "Advanced Energy Design Guides."
- C. Shop Drawings:
 1. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Equipment room drawing or BIM model, drawn to scale, on which the items described in this Section are shown and coordinated with all building trades.
- B. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- C. Source quality-control reports.
- D. Field quality-control reports.
- E. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.6 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- c. Deterioration of metals, metal finishes, and other materials beyond normal use.
- 2. Warranty Periods: From date of Substantial Completion.
 - a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:
 - 1) Storage Tank: Five years.
 - 2) Controls and Other Components: Two year(s).
 - b. Commercial, Finned-Tube, Gas-Fired, Domestic-Water Heaters:
 - 1) Heat Exchanger: Five years.
 - 2) Controls and Other Components: Two year(s).
 - 3) Separate Hot-Water Storage Tanks: Five years.
 - c. Gas-Fired, Tankless, Domestic-Water Heaters:
 - 1) Heat Exchanger: Five years.
 - 2) Controls and Other Components: Three years.
 - d. Residential, Gas-Fired, Storage, Domestic-Water Heaters:
 - 1) Storage Tank: Five years.
 - 2) Controls and Other Components: Three years.
 - e. Commercial, Gas- and Oil-Fired, Domestic-Water Heaters:
 - 1) Storage Tank: Five years.
 - 2) Burner: Two year(s).
 - 3) Controls and Other Components: Two years.
 - f. Expansion Tanks: Five years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.
- B. ASHRAE/IES Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IES 90.1.
- C. ASME Compliance:
 - 1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

2.2 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

- A. Commercial, Atmospheric, Gas-Fired, Storage, Domestic-Water Heaters:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. O. Smith Corporation.
 - b. Bradford White Corporation.
 - c. Lochinvar, LLC.
 - d. PVI; A WATTS Brand.
 - e. Rheem Manufacturing Company.
 - f. State Industries.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 3. Standard: ANSI Z21.10.3/CSA 4.3.
 4. Storage-Tank Construction: ASME-code steel with 150-psig working-pressure rating.
 - a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
 - 2) NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.
 - b. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Lining: Cement, Glass, Nickel plate, Phenolic coating, Sheet copper, complying with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
 5. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - d. Insulation: Comply with ASHRAE/IES 90.1. Surround entire storage tank except connections and controls.
 - e. Jacket: Steel with enameled finish.
 - f. Burner: For use with atmospheric, gas-fired, domestic-water heaters and natural-gas fuel.
 - g. Ignition: Standing pilot or ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.
 - h. Temperature Control: Adjustable thermostat.
 - i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
 - j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.
 6. Special Requirements: NSF 5 construction.
 7. Draft Hood: Draft diverter, complying with ANSI Z21.12.
- B. Commercial, Power-Burner, Gas-Fired, Storage, Domestic-Water Heaters:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. O. Smith Corporation.
 - b. Precision Boilers.
 - c. PVI; A WATTS Brand.
 - d. State Industries.
 2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 3. Standard: ANSI Z21.10.3/CSA 4.3.
 4. Storage-Tank Construction: ASME-code steel with 150-psig working-pressure rating.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
 - 2) NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.
 - b. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Lining: Cement, Glass, Nickel plate, Phenolic coating, Sheet copper, complying with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
5. Factory-Installed, Storage-Tank Appurtenances:
- a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - d. Insulation: Comply with ASHRAE/IES 90.1. Surround entire storage tank except connections and controls.
 - e. Jacket: Steel with enameled finish.
 - f. Burner: UL 795 for power-burner, gas-fired, domestic-water heaters and natural-gas fuel.
 - g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.
 - h. Temperature Control: Adjustable thermostat.
 - i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
 - j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.
6. Draft Hood: Draft diverter, complying with ANSI Z21.12.
- C. Commercial, Power-Vent, Gas-Fired, Storage, Domestic-Water Heaters:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. O. Smith Corporation.
 - b. Bradford White Corporation.
 - c. Rheem Manufacturing Company.
 - d. State Industries.
 2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 3. Standard: ANSI Z21.10.3/CSA 4.3.
 4. Storage-Tank Construction: ASME-code steel with 150-psig working-pressure rating.
 - a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
 - 2) NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

5. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - d. Insulation: Comply with ASHRAE/IES 90.1. Surround entire storage tank except connections and controls.
 - e. Jacket: Steel with enameled finish.
 - f. Burner: For use with power-vent, gas-fired, domestic-water heaters and natural-gas fuel.
 - g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.
 - h. Temperature Control: Adjustable thermostat.
 - i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
 - j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.
 6. Special Requirements: NSF 5 construction.
 7. Power-Vent System: Exhaust fan, interlocked with burner.
- D. Commercial, Direct-Vent, Gas-Fired, Storage, Domestic-Water Heaters:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bradford White Corporation.
 - b. Lochinvar, LLC.
 - c. State Industries.
 2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 3. Standard: ANSI Z21.10.1/CSA 4.1.
 4. Storage-Tank Construction: Steel.
 - a. Tappings: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: 150 psig.
 - c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
 5. Factory-Installed Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - d. Insulation: Comply with ASHRAE/IES 90.1.
 - e. Jacket: Steel with enameled finish.
 - f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
 - g. Burner: For use with direct-vent, gas-fired, domestic-water heaters and natural-gas fuel.
 - h. Ignition: Standing pilot or ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.
 - i. Temperature Control: Adjustable thermostat.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- j. Combination Temperature-and-Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.
- 6. Direct-Vent System: Through-wall or roof, coaxial- or double-channel vent assembly with domestic-water heater manufacturers' outside intake/exhaust screen.
- E. Commercial, Gas-Fired, High-Efficiency, Storage, Domestic-Water Heaters:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. O. Smith Corporation.
 - b. Bradford White Corporation.
 - c. PVI; A WATTS Brand.
 - d. Rheem Manufacturing Company.
 - e. State Industries.
 - 2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 - 3. Standard: ANSI Z21.10.3/CSA 4.3.
 - 4. Description: Manufacturer's proprietary design to provide at least 95 percent combustion efficiency at optimum operating conditions.
 - 5. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - d. Insulation: Comply with ASHRAE/IES 90.1. Surround entire storage tank except connections and controls.
 - e. Jacket: Steel with enameled finish.
 - f. Burner or Heat Exchanger: Comply with UL 795 or approved testing agency requirements for gas-fired, high-efficiency, domestic-water heaters and natural-gas fuel.
 - g. Temperature Control: Adjustable thermostat.
 - h. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
 - i. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.
 - 6. Draft Hood: Draft diverter, complying with ANSI Z21.12.

2.3 COMMERCIAL, FINNED-TUBE, GAS-FIRED, DOMESTIC-WATER HEATERS

- A. Commercial, Coil-Type, Finned-Tube, Gas-Fired, Domestic-Water Heaters:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. O. Smith Corporation.
 - b. Bradford White Corporation.
 - c. Laars Heating Systems Company; a subsidiary of Bradford White Corporation.
 - d. Raypac.
 - 2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Standard: ANSI Z21.13/CSA 4.9 for hot-water-supply boilers.
4. Description: Packaged unit with boiler, separate hot-water storage tank, pump, piping, and controls.
5. Boiler Construction: ASME code with 160-psig working-pressure rating for hot-water-supply boiler, domestic-water heater.
 - a. Heat Exchanger: Helix or spiral, finned-copper-tube coils with bronze headers.
 - b. Connections: Factory fabricated of materials compatible with boiler. Attach to boiler before testing.
 - 1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
 - 2) NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.
6. Boiler Appurtenances:
 - a. Insulation: Comply with ASHRAE/IES 90.1. Surround entire boiler except connections and controls.
 - b. Jacket: Steel with enameled finish.
 - c. Burner: For use with coil-type, finned-tube, gas-fired, domestic-water heaters and natural-gas fuel.
 - d. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 60730-2-5, intermittent electronic-ignition system.
 - e. Temperature Control: Adjustable, storage-tank temperature-control fitting and flow switch, interlocked with circulator and burner.
 - f. Safety Control: Automatic, high-temperature-limit cutoff device or system.
7. Support: Steel base or skids.
8. Draft Hood: Draft diverter, complying with ANSI Z21.12.
9. Hot-Water Storage Tank: Connected with piping to circulating pump and domestic-water heater.
 - a. Construction: In accordance with ASME Boiler and Pressure Vessel Code: Section VIII, steel with 150-psig working-pressure rating.
 - b. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
 - 2) NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.
 - c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
10. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rods: Factory installed, magnesium.
 - b. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - c. Insulation: Comply with ASHRAE/IES 90.1. Surround entire storage tank except connections and controls.
 - d. Jacket: Steel with enameled finish.
 - e. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

11. Circulating Pump: UL 778, all-bronze, centrifugal, overhung-impeller, separately coupled in-line pump as defined in HI 1.1-1.2 and HI 1.3. Include mechanical seals, 125-psig minimum working-pressure rating, and 225 deg F continuous-water-temperature rating.
 12. Piping: Copper tubing; copper, solder-joint fittings; and brazed or flanged joints.
 13. Mounting: Domestic-water heater, tank, and accessories factory mounted on skids.
- B. Commercial, Grid-Type, Finned-Tube, Gas-Fired, Domestic-Water Heaters:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. O. Smith Corporation.
 - b. Bradford White Corporation.
 - c. Laars Heating Systems Company; a subsidiary of Bradford White Corporation.
 - d. Lochinvar, LLC.
 - e. Raypak.
 - f. RBI.
 - g. Rheem Manufacturing Company.
 2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 3. Standard: ANSI Z21.13/CSA 4.9 for hot-water-supply boilers.
 4. Description: Packaged unit with boiler, storage tank, pump, piping, and controls.
 5. Boiler Construction: ASME code with 160-psig working-pressure rating for hot-water-boiler-type, domestic-water heater.
 - a. Heat Exchanger: Horizontal, straight, finned-copper tubes with bronze headers.
 - b. Connections: Factory fabricated of materials compatible with boiler. Attach to boiler before testing.
 - 1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
 - 2) NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.
 6. Boiler Appurtenances:
 - a. Insulation: Comply with ASHRAE/IES 90.1. Surround entire boiler except connections and controls.
 - b. Jacket: Steel with enameled finish.
 - c. Burner: For use with grid-type, finned-tube, gas-fired, domestic-water heaters and natural-gas fuel.
 - d. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 60730-2-5, intermittent electronic-ignition system.
 - e. Temperature Control: Adjustable, storage-tank temperature-control fitting and flow switch, interlocked with circulator and burner.
 - f. Safety Control: Automatic, high-temperature-limit cutoff device or system.
 7. Support: Steel base or skids.
 8. Draft Hood: Draft diverter, complying with ANSI Z21.12.
 9. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rods: Factory installed, magnesium.
 - b. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - c. Insulation: Comply with ASHRAE/IES 90.1. Surround entire storage tank except connections and controls.
 - d. Jacket: Steel with enameled finish.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- e. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.
 - 10. Circulating Pump: UL 778, all-bronze, centrifugal, overhung-impeller, separately coupled in-line pump as defined in HI 1.1-1.2 and HI 1.3. Include mechanical seals, 125-psig minimum working-pressure rating, and 225 deg F continuous-water-temperature rating.
 - 11. Piping: Copper tubing; copper, solder-joint fittings; and brazed or flanged joints.
 - 12. Mounting: Domestic-water heater, tank, and accessories factory mounted on skids.
- 2.4 GAS-FIRED, TANKLESS, DOMESTIC-WATER HEATERS
- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. A. O. Smith Corporation.
 - 2. Bradford White Corporation.
 - 3. Laars Heating Systems Company; a subsidiary of Bradford White Corporation.
 - 4. NORITZ America Corp.
 - 5. Rheem Manufacturing Company.
 - 6. Rinnai Corporation.
 - 7. State Industries.
 - B. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 - C. Standard: ANSI Z21.10.3/CSA 4.3 for gas-fired, instantaneous, domestic-water heaters for indoor application.
 - D. Construction: Copper piping or tubing complying with NSF 61 and NSF 372 barrier materials for potable water, without storage capacity.
 - 1. Tappings: ASME B1.20.1 pipe thread.
 - 2. Pressure Rating: 150 psig.
 - 3. Heat Exchanger: Copper tubing or Stainless steel.
 - 4. Insulation: Comply with ASHRAE/IES 90.1.
 - 5. Jacket: Metal, with enameled finish, or plastic.
 - 6. Burner: For use with tankless, domestic-water heaters and natural-gas fuel.
 - 7. Automatic Ignition: Manufacturer's proprietary system for automatic, gas ignition.
 - 8. Temperature Control: Adjustable thermostat.
 - E. Support: Bracket for wall mounting.
- 2.5 RESIDENTIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS
- A. Residential, Atmospheric, Gas-Fired, Storage, Domestic-Water Heaters:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. O. Smith Corporation.
 - b. Bradford White Corporation.
 - c. Lochinvar, LLC.
 - d. Rheem Manufacturing Company.
 - e. State Industries.
 - 2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 - 3. Standard: ANSI Z21.10.1/CSA 4.1.
 - 4. Storage-Tank Construction: Steel.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Tappings: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: 150 psig.
 - c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
 5. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - d. Insulation: Comply with ASHRAE/IES 90.1.
 - e. Jacket: Steel with enameled finish.
 - f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
 - g. Burner: For use with atmospheric, gas-fired, domestic-water heaters and natural-gas fuel.
 - h. Ignition: Standing pilot or ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.
 - i. Temperature Control: Adjustable thermostat.
 - j. Combination Temperature-and-Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.
 6. Draft Hood: Low-profile-type draft diverter, complying with ANSI Z21.12.
- B. Residential, Direct-Vent, Gas-Fired, Storage, Domestic-Water Heaters:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. O. Smith Corporation.
 - b. Bradford White Corporation.
 - c. Lochinvar, LLC.
 - d. Rheem Manufacturing Company.
 - e. State Industries.
 2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 3. Standard: ANSI Z21.10.1/CSA 4.1.
 4. Storage-Tank Construction: Steel.
 - a. Tappings: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: 150 psig.
 - c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
 5. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - d. Insulation: Comply with ASHRAE/IES 90.1.
 - e. Jacket: Steel with enameled finish.
 - f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
 - g. Burner: For use with direct-vent, gas-fired, domestic-water heaters and natural-gas fuel.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- h. Ignition: Standing pilot or ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.
 - i. Temperature Control: Adjustable thermostat.
 - j. Combination Temperature-and-Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.
 - 6. Direct-Vent System: Through-wall or roof, coaxial- or double-channel vent assembly with domestic-water heater manufacturers' outside intake/exhaust screen.
 - C. Residential, Power-Vent, Gas-Fired, Storage, Domestic-Water Heaters:
 - 1. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 - 2. Standard: ANSI Z21.10.1/CSA 4.1.
 - 3. Storage-Tank Construction: Steel.
 - a. Tappings: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: 150 psig.
 - c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
 - 4. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - d. Insulation: Comply with ASHRAE/IES 90.1.
 - e. Jacket: Steel with enameled finish.
 - f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
 - g. Burner: For use with power-vent, gas-fired, domestic-water heaters and natural-gas fuel.
 - h. Ignition: Standing pilot or ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.
 - i. Temperature Control: Adjustable thermostat.
 - j. Combination Temperature-and-Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.
 - 5. Power-Vent System: Exhaust fan, interlocked with burner.
- 2.6 COMMERCIAL, GAS- AND OIL-FIRED, DOMESTIC-WATER HEATERS
 - A. Description: Comply with ANSI Z21.10.3/CSA 4.3 or UL 732 requirements appropriate for dual-fuel, gas- and oil-fired, domestic-water heaters.
 - B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. A. O. Smith Corporation.
 - 2. Precision Boilers.
 - 3. PVI; A WATTS Brand.
 - 4. State Industries.
 - C. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 - D. Storage-Tank Construction: ASME-code steel with 150-psig minimum working-pressure rating.
 - 1. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
- b. NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.

E. Factory-Installed, Storage-Tank Appurtenances:

1. Anode Rod: Replaceable magnesium.
2. Dip Tube: Required unless cold-water inlet is near bottom of tank.
3. Drain Valve: Corrosion-resistant metal with hose-end connection.
4. Insulation: Comply with ASHRAE/IES 90.1.
5. Jacket: Steel with enameled finish.
6. Temperature Control: Adjustable thermostat.
7. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.

F. Fuel Burner:

1. Standards: Combination gas-and-oil burner assembly, complying with appropriate requirements of UL 795; or comply with UL 296 for oil burners for No. 2 fuel oil and UL 795 for natural-gas fuel.
2. Safety Control: Automatic, high-temperature-limit cutoff device or system.
3. Vent Connection: In accordance with standards of authorities having jurisdiction for dual-fuel, domestic-water heaters.

2.7 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Expansion Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. O. Smith Corporation.
 - b. AMTROL, Inc.
 - c. State Industries.
 - d. TACO Comfort Solutions, Inc.
2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
3. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
4. Construction:
 - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
 - b. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.
5. Capacity and Characteristics:
 - a. Working-Pressure Rating: 150 psig.
 - b. Capacity Acceptable: 2 gal. minimum.
 - c. Air Precharge Pressure: 20 psig.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads.
 - C. Piping-Type Heat Traps: Field-fabricated piping arrangement in accordance with ASHRAE/IES 90.1.
 - D. Heat-Trap Fittings: ASHRAE 90.2.
 - E. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section 22 05 23.12 "Ball Valves for Plumbing Piping," Section 22 05 23.13 "Butterfly Valves for Plumbing Piping," and Section 22 05 23.15 "Gate Valves for Plumbing Piping."
 - 1. Comply with requirements for balancing valves specified in Section 22 11 19 "Domestic Water Piping Specialties."
 - F. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1, manually operated. Furnish for installation in piping.
 - G. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 1/2-psig pressure rating as required to match gas supply.
 - H. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.
 - I. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valves with sensing element that extends into storage tank.
 - 1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4.
 - 2. Oil-Fired, Domestic-Water Heaters: ASME rated and stamped.
 - J. Pressure Relief Valves: Include pressure setting less than working-pressure rating of domestic-water heater.
 - 1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4.
 - 2. Oil-Fired, Domestic-Water Heaters: ASME rated and stamped.
 - K. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.
 - L. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Provide dimension that will support bottom of domestic-water heater minimum of 18 inches above the floor.
 - M. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.
- 2.8 SOURCE QUALITY CONTROL
- A. Factory Tests: Test and inspect assembled domestic-water heaters and storage tanks specified to be ASME-code construction, in accordance with ASME Boiler and Pressure Vessel Code.
 - B. Hydrostatically test commercial domestic-water heaters and storage tanks to minimum of one and one-half times pressure rating before shipment.
 - C. Domestic-water heaters will be considered defective if they do not pass tests and inspections.
 - D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

- A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in Section 03 30 00 "Cast-in-Place Concrete."
 - 1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
 - 2. Maintain manufacturer's recommended clearances.
 - 3. Arrange units so controls and devices that require servicing are accessible.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 7. Install anchor bolts to elevations required for proper attachment to supported equipment.
 8. Anchor domestic-water heaters to substrate.
- B. Residential, Domestic-Water Heater Mounting: Install residential domestic-water heaters on water-heater stand on floor or domestic-water heater mounting bracket.
1. Maintain manufacturer's recommended clearances.
 2. Arrange units so controls and devices that require servicing are accessible.
 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
 5. Anchor domestic-water heaters to substrate.
- C. Tankless, Domestic-Water Heater Mounting: Install tankless, domestic-water heaters at least 18 inches above floor on wall bracket.
1. Maintain manufacturer's recommended clearances.
 2. Arrange units so controls and devices that require servicing are accessible.
 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
 5. Anchor domestic-water heaters to substrate.
- D. Install domestic-water heaters level and plumb, in accordance with layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 22 05 23.12 "Ball Valves for Plumbing Piping," Section 22 05 23.13 "Butterfly Valves for Plumbing Piping," and Section 22 05 23.15 "Gate Valves for Plumbing Piping."
- E. Install gas-fired, domestic-water heaters in accordance with NFPA 54.
1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
 2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
 3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
 4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 23 11 23 "Facility Natural-Gas Piping."
- F. Install oil-fired, domestic-water heaters in accordance with NFPA 31.
1. Install shutoff valves on fuel-oil supply piping to oil-fired water-heater burners without shutoff valves. Comply with requirements for shutoff valves specified in Section 23 11 13 "Facility Fuel-Oil Piping."
- G. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend domestic-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- H. Install combination temperature-and-pressure relief valves in water piping for domestic-water heaters without storage. Extend domestic-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
 - I. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 22 11 19 "Domestic Water Piping Specialties."
 - J. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 22 05 19 "Meters and Gages for Plumbing Piping."
 - K. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet. Comply with requirements for valves specified in Section 22 05 23.12 "Ball Valves for Plumbing Piping," Section 22 05 23.13 "Butterfly Valves for Plumbing Piping," and Section 22 05 23.15 "Gate Valves for Plumbing Piping," and comply with requirements for thermometers specified in Section 22 05 19 "Meters and Gages for Plumbing Piping."
 - L. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.
 - M. Fill domestic-water heaters with water.
 - N. Charge domestic-water expansion tanks with air to required system pressure.
 - O. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water shall contain less than 0.25 percent of lead by weight.
- 3.2 PIPING CONNECTIONS
- A. Comply with requirements for domestic-water piping specified in Section 22 11 16 "Domestic Water Piping."
 - B. Comply with requirements for fuel-oil piping specified in Section 23 11 13 "Facility Fuel-Oil Piping."
 - C. Comply with requirements for gas piping specified in Section 23 11 23 "Facility Natural-Gas Piping."
 - D. Drawings indicate general arrangement of piping, fittings, and specialties.
 - E. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.
- 3.3 IDENTIFICATION
- A. Identify system components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."
- 3.4 FIELD QUALITY CONTROL
- A. Perform tests and inspections.
 - B. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - C. Domestic-water heaters will be considered defective if they do not pass tests and inspections.
 - D. Prepare test and inspection reports.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3.5 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, storage, gas-fired, tankless commercial, gas- and oil-fired, domestic-water heaters. Training shall be a minimum of one hour(s).

END OF SECTION

SECTION 22 42 13.13 - COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Floor-mounted, bottom-outlet water closets.
 - 2. Wall-mounted water closets.
 - 3. Flushometer valves.
 - 4. Toilet seats.
 - 5. Supports.

1.3 DEFINITIONS

- A. Effective Flush Volume: Average of two reduced flushes and one full flush per fixture.
- B. Remote Water Closet: Located more than 30 feet from other drain line connections or fixture and where less than 1.5 drainage fixture units are upstream of the drain line connection.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Sustainable Design Submittals:
 - 1. Plumbing Fixtures: Provide the following:
 - a. Manufacturer cut sheet indicating water consumption.
 - b. WaterSense certification for residential fixtures, commercial water closets, commercial urinals, and commercial showers.
- C. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

- A. Water Closets, Floor Mounted, Bottom Outlet, Top Spud:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard.
 - b. Briggs Plumbing Products, Inc.
 - c. Crane Plumbing, L.L.C.
 - d. Gerber Plumbing Fixtures LLC.
 - e. Kohler Co.
 - f. Peerless Pottery Sales, Inc.
 - g. Sloan Valve Company.
 - h. TOTO USA, INC.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- i. Zurn Industries, LLC.
 2. Bowl:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Siphon jet.
 - d. Style: Flushometer valve.
 - e. Height: Standard or Handicapped/elderly, complying with ICC/ANSI A117.1.
 - f. Rim Contour: Elongated.
 - g. Water Consumption: 1.28 gal. per flush.
 - h. Spud Size and Location: NPS 1-1/2; top.
 - i. Color: White.
 3. Bowl-to-Drain Connecting Fitting: ASTM A1045 or ASME A112.4.3.
 - B. Water Closets, Floor Mounted, Bottom Outlet, Close-Coupled Flushometer Tank:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard.
 - b. Kohler Co.
 - c. Zurn Industries, LLC.
 2. Bowl:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASSE/ASME 1037/CSA B125.37.
 - b. Material: Vitreous china.
 - c. Type: Siphon jet.
 - d. Style: Pressure assisted.
 - e. Height: Standard or Handicapped/elderly, complying with ICC/ANSI A117.1.
 - f. Rim Contour: Elongated.
 - g. Water Consumption: Maximum 1.1 gal per flush.
 - h. Color: White.
 3. Bowl-to-Drain Connecting Fitting: ASTM A1045 or ASME A112.4.3.
 4. Flushometer Tank: Pressure assisted.
- 2.2 FLUSHOMETER VALVES
 - A. Lever-Handle, Piston Flushometer Valves:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard.
 - b. Kohler Co.
 - c. Sloan Valve Company.
 - d. TOTO USA, INC.
 - e. Zurn Industries, LLC.
 2. Standard: ASSE 1037.
 3. Minimum Pressure Rating: 125 psig.
 4. Features: Include integral check stop and backflow-prevention device.
 5. Material: Brass body with corrosion-resistant components.
 6. Exposed Flushometer-Valve Finish: Chrome plated.
 7. Consumption: 1.28 gal. per flush.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

8. Minimum Inlet: NPS 1.
9. Minimum Outlet: NPS 1-1/4.

B. Battery-Powered, Solenoid-Actuator, Piston Flushometer Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard.
 - b. Kohler Co.
 - c. Moen Incorporated.
 - d. Sloan Valve Company.
 - e. TOTO USA, INC.
 - f. Zurn Industries, LLC.
2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Actuator: Solenoid complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
8. Trip Mechanism: Battery-powered electronic sensor complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
9. Consumption: 1.28 gal. per flush.
10. Minimum Inlet: NPS 1.
11. Minimum Outlet: NPS 1-1/4.

2.3 TOILET SEATS

A. Toilet Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard.
 - b. Bemis Manufacturing Company.
 - c. Church Seats; Bemis Manufacturing Company.
 - d. Kohler Co.
 - e. Olsonite Seat Co.
 - f. TOTO USA, INC.
 - g. Zurn Industries, LLC.
2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial (Standard).
5. Shape: Elongated rim, open front.
6. Hinge: Self-sustaining, check.
7. Hinge Material: Noncorroding metal.
8. Seat Cover: Not required.
9. Color: White.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.
- B. Examine walls and floors for suitable conditions where water closets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Water-Closet Installation:

- 1. Install level and plumb according to roughing-in drawings.
- 2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.

B. Flushometer-Valve Installation:

- 1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
- 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
- 3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
- 4. Install actuators in locations that are easy for people with disabilities to reach.
- 5. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

C. Install toilet seats on water closets.

D. Wall Flange and Escutcheon Installation:

- 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
- 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
- 3. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

E. Joint Sealing:

- 1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
- 2. Match sealant color to water-closet color.
- 3. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."

3.3 CONNECTIONS

- A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.
- B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 ADJUSTING

- A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

- A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed water closets and fittings.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 42 13.16 - COMMERCIAL URINALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Wall-hung urinals.
 - 2. Urinal flushometer valves.
 - 3. Supports.
- B. Related Requirements:

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for urinals.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Sustainable Design Submittals:
 - 1. Plumbing Fixtures: Provide the following:
 - a. Manufacturer cut sheet indicating water consumption.
 - b. WaterSense certification for residential fixtures, commercial water closets, commercial urinals, and commercial showers.
- C. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than six of each type.

PART 2 - PRODUCTS

2.1 WALL-HUNG URINALS

- A. Urinals - Wall Hung, Back Outlet, Blowout: .
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard.
 - b. Kohler Co.
 - c. Zurn.
 - 2. Fixture:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5/CSA B45.15.
 - b. Material: Vitreous china.
 - c. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
 - d. Water Consumption: 0.125 gpf.
 - e. Spud Size and Location: NPS 1-1/4; top.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- f. Outlet Size and Location: NPS 2; back.
 - g. Color: White.
 - 3. Waste Fitting:
 - a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
 - b. Size: NPS 2.
 - 4. Support: Type I urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture.
 - 5. Urinal Mounting Height: Standard or Handicapped/elderly according to ICC A117.1.
 - B. Urinals - Wall Hung, Back Outlet, Siphon Jet: Accessible.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard.
 - b. Briggs Plumbing Products, Inc.
 - c. Kohler Co.
 - d. Zurn Industries, LLC.
 - 2. Fixture:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5/CSA B45.15.
 - b. Material: Vitreous china.
 - c. Type: Siphon jet with extended shields.
 - d. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
 - e. Water Consumption: 0.125 gpf.
 - f. Spud Size and Location: NPS 3/4; top.
 - g. Outlet Size and Location: NPS 2; back.
 - h. Color: White.
 - 3. Waste Fitting:
 - a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
 - b. Size: NPS 2.
 - 4. Support: Type I urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture.
 - 5. Urinal Mounting Height: Standard or Handicapped/elderly according to ICC A117.1.
- 2.2 URINAL FLUSHOMETER VALVES
 - A. Lever-Handle, Diaphragm Flushometer Valves: .
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard.
 - b. Sloan Valve Company.
 - c. Zurn Industries, LLC.
 - 2. Standard: ASSE 1037/ASME 112.1037/CSA B125.37.
 - 3. Minimum Pressure Rating: 125 psig.
 - 4. Features: Include integral check stop and backflow-prevention device.
 - 5. Material: Brass body with corrosion-resistant components.
 - 6. Exposed Flushometer-Valve Finish: Chrome plated.
 - 7. Style: Exposed.
 - 8. Consumption: 0.5 gal. per flush.
 - 9. Minimum Inlet: NPS 3/4.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

10. Minimum Outlet: NPS 3/4.

B. Lever-Handle, Piston Flushometer Valves: .

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard.
 - b. Kohler Co.
 - c. Sloan Valve Company.
 - d. TOTO USA, INC.
 - e. Zurn Industries, LLC.
2. Standard: ASSE 1037/ASME 112.1037/CSA B125.37.
3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Style: Exposed.
8. Consumption: 0.5 gal. per flush.
9. Minimum Inlet: NPS 3/4.
10. Minimum Outlet: NPS 3/4.

C. Battery-Powered, Solenoid-Actuator, Piston Flushometer Valves: .

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard.
 - b. Kohler Co.
 - c. Sloan Valve Company.
 - d. TOTO USA, INC.
 - e. Zurn Industries, LLC.
2. Standard: ASSE 1037/ASME 112.1037/CSA B125.37.
3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: Exposed.
9. Actuator: Solenoid complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
10. Trip Mechanism: Battery-powered electronic sensor complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
11. Consumption: 0.5 gal. per flush.
12. Minimum Inlet: NPS 3/4.
13. Minimum Outlet: NPS 3/4.

2.3 SUPPORTS

A. Type I Urinal Carrier:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Jay R. Smith Mfg Co; a division of Morris Group International.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. Wade Drains.
 - e. WATTS.
 - f. Zurn Industries, LLC.
2. Standard: ASME A112.6.1M.
- B. Type II Urinal Carrier:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg Co; a division of Morris Group International.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. Wade Drains.
 - e. WATTS.
 - f. Zurn Industries, LLC.
 2. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before urinal installation.
- B. Examine walls and floors for suitable conditions where urinals will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Urinal Installation:
 1. Install urinals level and plumb according to rough-in drawings.
 2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
 3. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC A117.1.
 4. Install trap-seal liquid in waterless urinals.
- B. Support Installation:
 1. Install supports, affixed to building substrate, for wall-hung urinals.
 2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
- C. Flushometer-Valve Installation:
 1. Install flushometer-valve water-supply fitting on each supply to each urinal.
 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
 3. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.
 4. Install fresh batteries in battery-powered, electronic-sensor mechanisms.
- D. Wall Flange and Escutcheon Installation:
 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
 3. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

E. Joint Sealing:

1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to urinal color.

3.3 PIPING CONNECTIONS

- A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.
- B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

- A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

- A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed urinals and fittings.
- C. Do not allow use of urinals for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 42 16.13 - COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Enameled, cast-iron, counter-mounted lavatories.
 - 2. Vitreous-china, counter-mounted lavatories.
 - 3. Enameled, cast-iron, wall-mounted lavatories.
 - 4. Vitreous-china, wall-mounted lavatories.
 - 5. Precast GFRC, wall-mounted lavatories.
 - 6. Precast GFRC, freestanding lavatories.
 - 7. Lavatory systems.
 - 8. Manually operated lavatory faucets.
 - 9. Automatically operated lavatory faucets.
 - 10. Supply fittings.
 - 11. Waste fittings.
 - 12. Lavatory supports.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Sustainable Design Submittals:
 - 1. Plumbing Fixtures: Provide the following:
 - a. Manufacturer cut sheet indicating water consumption.
 - b. WaterSense certification for residential fixtures, commercial water closets, commercial urinals, and commercial showers.
- C. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.
 - 1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
 - a. Servicing and adjustments of automatic faucets.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, COUNTER-MOUNTED LAVATORIES

- A. Lavatory - Self-Rimming, Vitreous China, Counter Mounted:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard.
 - b. Crane Plumbing, L.L.C.
 - c. Kohler Co.
 - d. Sloan Valve Company.
 - e. TOTO USA, INC.
 - f. Zurn Industries, LLC.
 2. Fixture:
 - a. Standard: ASME A112.19.2/CSA B45.1.
 - b. Type: Self-rimming for above-counter mounting.
 - c. Color: White.
 - d. Mounting Material: Sealant.
 3. Faucet: Insert lavatory faucet designation from "Manually Operated Lavatory Faucets" or "Automatically Operated Lavatory Faucets" Article.
- B. Lavatory - Vitreous China, Undercounter Mounted:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard.
 - b. Kohler Co.
 - c. Sloan Valve Company.
 - d. TOTO USA, INC.
 - e. Zurn Industries, LLC.
 2. Fixture:
 - a. Standard: ASME A112.19.2/CSA B45.1.
 - b. Type: For undercounter mounting.
 - c. Color: White.
 - d. Mounting Material: Sealant and undercounter mounting kit.

2.2 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

- A. Lavatory - Vitreous China, Wall Mounted, with Back:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard.
 - b. Kohler Co.
 - c. Sloan Valve Company.
 - d. Zurn Industries, LLC.
 2. Fixture:
 - a. Standard: ASME A112.19.2/CSA B45.1.
 - b. Type: For wall hanging.
 - c. Color: White.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- d. Mounting Material: Chair carrier.
 3. Support: Type II, concealed-arm lavatory carrier..
 4. Lavatory Mounting Height: Standard or Handicapped/elderly in accordance with ICC A117.1.
- B. Lavatory - Ledge Back, Vitreous China, Wall Mounted:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard.
 - b. Kohler Co.
 - c. Sloan Valve Company.
 - d. Zurn.
 2. Fixture:
 - a. Standard: ASME A112.19.2/CSA B45.1.
 - b. Type: For wall hanging.
 - c. Color: White.
 - d. Mounting Material: Chair carrier.
 3. Support: Type II, concealed-arm lavatory carrier.
 4. Lavatory Mounting Height: Standard or Handicapped/elderly in accordance with ICC A117.1.
- C. Lavatory - Wheelchair, Vitreous China, Wall Mounted:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard.
 - b. Kohler Co.
 - c. Sloan Valve Company.
 - d. Zurn Industries, LLC.
 2. Fixture:
 - a. Standard: ASME A112.19.2/CSA B45.1.
 - b. Type: Slab or wheelchair.
 - c. Nominal Size: Rectangular, 27 by 20 inches.
 - d. Color: White.
 - e. Mounting: For concealed-arm carrier.
 3. Support: Type II, concealed-arm lavatory carrier..
 4. Lavatory Mounting Height: Handicapped/elderly in accordance with ICC A117.1.
- D. Lavatory - Corner Type, Vitreous China, Wall Mounted:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard.
 - b. Sloan Valve Company.
 2. Fixture:
 - a. Standard: ASME A112.19.2/CSA B45.1.
 - b. Type: Three-sided-front apron with three-sided back.
 - c. Nominal Size: Corner, 16 by 16 inches.
 - d. Color: White.
 - e. Mounting Materials: Wall brackets.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Support: Type III lavatory carrier with two hanger plates made for corner lavatories..
4. Lavatory Mounting Height: Standard or Handicapped/elderly in accordance with ICC A117.1.

2.3 PRECAST GFRC, WALL-MOUNTED, SINGLE-BASIN, MULTI-STATION LAVATORY

- A. Lavatory - Precast GFRC, Two-Station, Wall-Mounted, Rectangular Countertop Deck with Single Integral Ramp Basin:

1. Fixture:
 - a. Standard: CSA B45.8/IAPMO Z403 and ICC A117.1.
 - b. Type: Straight front and side aprons with straight back.
 - c. Drain Type: Slot drain.
 - d. Color: White linen.
 - e. Mounting Material: Concrete wall brackets.
2. Waste Fittings:
 - a. Standard: ASME A112.18.2/CSA B125.2.
 - b. Type: 1-1/2-inch slip joint connection.
 - c. Finish: Polished chrome.
3. Support: Manufacturer's standard product.
4. Lavatory Mounting Height: Standard or Handicapped/elderly in accordance with ICC A117.1.

- B. Lavatory - Precast GFRC, Three-Station, Wall-Mounted, Rectangular Countertop Deck with a Single Integral Ramp Basin:

1. Fixture:
 - a. Standard: CSA B45.8/IAPMO Z403 and ICC A117.1.
 - b. Type: Straight front and side aprons with straight back.
 - c. Drain Type: Slot drain.
 - d. Color: White linen.
 - e. Mounting Material: Concrete wall brackets.
2. Waste Fittings:
 - a. Standard: ASME A112.18.2/CSA B125.2.
 - b. Type: 1-1/2-inch slip joint connection.
 - c. Finish: Polished chrome.
3. Support: Manufacturer's standard product.
4. Lavatory Mounting Height: Standard or Handicapped/elderly in accordance with ICC A117.1.

2.4 MANUALLY OPERATED LAVATORY FAUCETS

- A. Lavatory faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61/NSF 372, or be certified in compliance with NSF 61/NSF 372 by an American National Standards Institute (ANSI) accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

- B. Lavatory Faucets - Manual Type: Single-Control Mixing, Commercial:

1. Standard: ASME A112.18.1/CSA B125.1.
2. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
3. Body Type: Centerset.
4. Body Material: Commercial, solid-brass, or die-cast housing with brazed copper and brass waterway.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

5. Finish: Polished chrome plate.
6. Maximum Flow Rate: 0.5 gpm.

2.5 AUTOMATICALLY OPERATED LAVATORY FAUCETS

- A. Lavatory faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61/NSF 372, or be certified in compliance with NSF 61/NSF 372 by an American National Standards Institute (ANSI) accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
- B. Lavatory Faucets - Automatic Type: Battery Powered Electronic Sensor Operated, Mixing,:
 1. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
 2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
 4. Body Type: Single hole.
 5. Body Material: Commercial, solid-brass, or die-cast housing with brazed copper and brass waterway.
 6. Finish: Polished chrome plate.
 7. Maximum Flow Rate: 0.5 gpm.
 8. Spout Outlet: Aerator.

2.6 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless steel wall flange.
- D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Wheel handle.
- F. Risers:
 1. NPS 3/8.
 2. Chrome-plated, rigid-copper-pipe and brass straight or offset tailpieces ASME A112.18.6/CSA B125.6, braided- or corrugated-stainless steel, flexible hose riser.

2.7 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.
- C. Trap:
 1. Size: NPS 1-1/2 by NPS 1-1/4.
 2. Material:
 - a. Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated, brass or steel wall flange.
 - b. Stainless steel, two-piece trap and swivel elbow with 0.012-inch thick stainless steel tube to wall, and stainless steel wall flange.

2.8 LAVATORY SUPPORTS

- A. Lavatory Carrier:
 1. Standard: ASME A112.6.1M.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.
- B. Examine counters and walls for suitable conditions where lavatories will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install lavatories level and plumb in accordance with roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-mounted lavatories.
- C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, in accordance with ICC A117.1.
- D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."
- E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."
- F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 22 07 19 "Plumbing Piping Insulation."

3.3 PIPING CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

- A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
- B. Install new batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

- A. After completing installation of lavatories, inspect and repair damaged finishes.
- B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed lavatories and fittings.
- D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 42 16.16 - COMMERCIAL SINKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Service sinks.
2. Kitchen/utility sinks.
3. Handwash sinks.
4. Manually operated sink faucets.
5. Automatically operated sink faucets.
6. Supply fittings.
7. Waste fittings.
8. Sink supports.
9. Grout.

B. Related Requirements:

1. Section 11 40 00 "Foodservice Equipment" for NSF-compliant foodservice and handwash sinks.
2. Section 22 41 00 "Residential Plumbing Fixtures" for residential sinks.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:

1. Plumbing Fixtures: Provide the following:
 - a. Manufacturer cut sheet indicating water consumption.
 - b. WaterSense certification for residential fixtures, commercial water closets, commercial urinals, and commercial showers.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted sinks.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sinks and faucets to include in operation and maintenance manuals.

1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
 - a. Servicing and adjustments for automatic faucets.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

PART 2 - PRODUCTS

2.1 SERVICE SINKS

A. Service Sinks - Molded Stone, Floor Mounted: .

1. Source Limitations: Obtain sinks from single source from single manufacturer.
2. Fixture:
 - a. Standard: ASME A112.18.2/CSA B125.2.
 - b. Shape: Square.
 - c. Nominal Size: 24 by 24 inches.
 - d. Height: 10 inches.
 - e. Rim Guard: On all top surfaces.
 - f. Color: Not applicable.
 - g. Drain: Grid with NPS 3 outlet.
3. Mounting: On floor and flush to wall.

B. Service Sinks - Enameled Cast Iron, Trap Standard Mounted: .

1. Source Limitations: Obtain sinks from single source from single manufacturer.
2. Fixture:
 - a. Standard: ASME A112.19.1/CSA B45.2.
 - b. Type: Service sink with back.
 - c. Back: Two faucet holes.
 - d. Nominal Size: 22 by 18 inches.
 - e. Color: White.
 - f. Mounting: NPS 3 P-trap standard with grid strainer inlet, cleanout, and floor flange.
 - g. Rim Guard: On front and sides.

C. Service Sinks - Enameled Cast Iron, Floor Mounted: .

1. Source Limitations: Obtain sinks from single source from single manufacturer.
2. Fixture:
 - a. Standard: ASME A112.19.1/CSA B45.2.
 - b. Style: With front apron and raised back.
 - c. Nominal Size: 28 by 28 inches.
 - d. Color: White.
 - e. Drain: Grid with NPS 3 outlet.
 - f. Rim Guard: Coated wire.

2.2 HANDWASH SINKS

A. Handwash Sinks - Stainless Steel: .

1. Source Limitations: Obtain sinks from single source from single manufacturer.
2. Fixture:
 - a. Standards:
 - 1) ASME A112.19.3/CSA B45.4.
 - 2) NSF 61.
 - b. Type: Wall-mounted stainless steel basin with radius corners, back for faucet, and support brackets.
 - c. Overall Dimensions: 17 by 16 by 5 inches.
 - d. Material: 18 gauge, Type 304 stainless steel.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Supply Fittings: Comply with requirements in "Supply Fittings" Article.
4. Waste Fittings: Comply with requirements in "Waste Fittings" Article.

2.3 MANUALLY OPERATED SINK FAUCETS

- A. Sink faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
- B. Commercial Sink Faucets - Manual Type: Single-control mixing,.
 1. Source Limitations: Obtain sink faucets from single source from single manufacturer.
 2. Standard: ASME A112.18.1/CSA B125.1.
 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
 4. Body Type: Centerset.
 5. Body Material: Commercial, solid brass, or die-cast housing with brazed copper and brass waterway.
 6. Finish: Chrome plated.
 7. Maximum Flow Rate: 1.0 to 1.28 gpm.
 8. Mounting Type: Deck, exposed or Back/wall, exposed.
 9. Valve Handle(s): Lever 4-inch wrist blade.
 10. Spout Type: Swivel gooseneck.
 11. Vacuum Breaker: Required for hose outlet.
 12. Spout Outlet: Hose thread in accordance with ASME B1.20.7.
 13. Pre-Rinse Unit:
 - a. Style: Flexible hose.
 - b. Riser: 18-inch rigid riser.
 - c. Hose: 44-inch flexible stainless steel with heat-resistant handle.
 - d. Wall bracket.
- C. Commercial Service Sink Faucets - Manual Type: .
 1. Source Limitations: Obtain sink faucets from single source from single manufacturer.
 2. Description: Wall/back mounted, brass body, with integral service stops, checks, spout with bucket/pail hook, 3/4-inch hose thread end, integral vacuum breaker, inlets 8 inches o.c., and two-handle mixing.
 3. Faucet:
 - a. Standards:
 - 1) ASME A112.18.1/CSA B125.1.
 - 2) NSF 61 and NSF 372.
 - 3) ICC A117.1.
 - 4) ASSE 1001 (VB).
 - b. Finish: Polished chrome plated.
 - c. Handles: Lever 6-inch wrist blade.
 - d. Cartridges: One-fourth turn compression Ceramic.
 - e. Brace: Adjustable top brace.

2.4 AUTOMATICALLY OPERATED SINK FAUCETS

- A. Sink faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

Jurisdiction (AHJ), and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

- B. Commercial Sink Faucets - Automatic Type: Battery-powered, electronic-sensor-operated, mixing.
1. Source Limitations: Obtain sink faucets from single source from single manufacturer.
 2. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
 3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
 5. Body Type: Centerset.
 6. Body Material: Commercial, solid brass, or die-cast housing with brazed copper and brass waterway.
 7. Finish: Chrome plated.
 8. Maximum Flow Rate: 0.5 gpm.
 9. Mounting Type: Deck.
 10. Spout Type: Swivel, gooseneck.
 11. Spout Outlet: Aerator.
 12. Thermostatic Mixing Valve: Below deck, adjustable temperature manual side handle, with hot/cold water indicators, with check valves.
 13. Control Module: Below deck, water-resistant module with internal flow setting switches.

2.5 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless steel wall flange.
- D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Wheel handle.
- F. Risers:
1. NPS 1/2.
 2. Chrome-plated, rigid-copper pipe.

2.6 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.
- C. Trap:
1. Size: NPS 1-1/2.
 2. Material:
 - a. Chrome-plated, two-piece, cast-brass trap and swivel elbow with 17-gauge brass tube to wall; and chrome-plated brass or steel wall flange.

2.7 SINK SUPPORTS

- A. Sink Carrier:
1. Source Limitations: Obtain sink supports from single source from single manufacturer.
 2. Standard: ASME A112.6.1M.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2.8 GROUT

- A. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000 psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for water-supply piping and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.
- B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install sinks level and plumb in accordance with rough-in drawings.
- B. Install supports, affixed to building substrate, for wall-hung sinks.
- C. Install wall-mounted sinks at accessible mounting height in accordance with ICC A117.1.
- D. Set floor-mounted sinks in leveling bed of cement grout.
- E. Install water-supply piping with stop on each supply to each sink faucet.
 - 1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 22 05 23.12 "Ball Valves for Plumbing Piping" and Section 22 05 23.15 "Gate Valves for Plumbing Piping."
 - 2. Install stops in locations where they can be easily reached for operation.
- F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."
- G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."
- H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 22 07 19 "Plumbing Piping Insulation."

3.3 PIPING CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

3.4 ELECTRICAL CONNECTIONS

- A. Connect wiring in accordance with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment in accordance with Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted in accordance with NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 26 05 53 "Identification for Electrical Systems."

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.5 ADJUSTING

- A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.
- B. Install new batteries in battery-powered, electronic-sensor mechanisms.

3.6 CLEANING AND PROTECTION

- A. After completing installation of sinks, inspect and repair damaged finishes.
- B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed sinks and fittings.
- D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 42 23 - COMMERCIAL SHOWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Individual shower receptors.
 - 2. Shower faucets.
 - 3. Shower basins.
 - 4. Group showers.
 - 5. Outdoor showers.
 - 6. Grout.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for showers.
 - 2. Include rated capacities, operating characteristics, and furnished specialties and accessories.
- B. Sustainable Design Submittals:
 - 1. Plumbing Fixtures: Provide the following:
 - a. Manufacturer cut sheet indicating water consumption.
 - b. WaterSense certification for residential fixtures, commercial water closets, commercial urinals, and commercial showers.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For shower faucets to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 INDIVIDUAL SHOWERS

- A. Individual FRP Showers, SH-1:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aquarius Bathware; a Praxis Company.
 - b. LASCO Bathware.
 - c. MAAX.
 - d. Sterling.
 - e. Swan Corporation (The).
 - 2. General: FRP shower enclosure with faucet and receptor
 - 3. Standard: ANSI Z124.1.2.
 - 4. Type: Sectional unit without top.
 - 5. Faucet: As shown on the Plumbing Schedule.
 - 6. Nominal Size and Shape 36 by 36 inches square
 - 7. Color: White
 - 8. Bathing Surface: Slip resistant according to ASTM F462.
 - 9. Outlet: Drain with NPS 2 outlet.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2.2 SHOWER FAUCETS

- A. NSF Standard: Comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects," for shower materials that will be in contact with potable water.
- B. Shower Faucets (Reference Plumbing Schedule):
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acorn Engineering Company; a Division of Morris Group International.
 - b. American Standard.
 - c. Chicago Faucets; Geberit Company.
 - d. Delta.
 - e. Kohler Co.
 - f. Lawler Manufacturing Company, Inc.
 - g. Leonard Valve Company.
 - h. POWERS; A WATTS Brand.
 - i. Zurn Industries, LLC.
 - 2. Description: Single-handle, pressure-balance mixing valve with hot- and cold-water indicators; check stops; and shower head.
 - 3. Faucet:
 - a. Standards: ASME A112.18.1/CSA B125.1 and ASSE 1016.
 - b. Body Material: Solid brass.
 - c. Finish: Polished chrome plate.
 - d. Shower-Arm, Flow-Control Fitting: 2.0 gpm
 - e. EPA WaterSense: Required.
 - f. Operation: Single-handle, push-pull or twist or rotate control.
 - g. Antiscald Device: Integral with mixing valve.
 - h. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.
 - 4. Supply Connections: NPS 1/2.
 - 5. Shower Head:
 - a. Standard: ASME A112.18.1/CSA B125.1.
 - b. Type: Ball joint with arm and flange.
 - c. Shower Head Material: Metallic with chrome-plated finish.
 - d. Integral Volume Control: Required.
 - e. Shower-Arm, Flow-Control Fitting: 2.0 gpm.
 - 6. FRP Shower Basins:

2.3 GROUT

- A. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before shower installation.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. Examine walls and floors for suitable conditions where showers will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Assemble shower components according to manufacturers' written instructions.
- B. Install showers level and plumb according to roughing-in drawings.
- C. Install water-supply piping with stop on each supply to each shower faucet.
 - 1. Exception: Use ball or gate valves if supply stops are not specified with shower. Comply with valve requirements specified in Section 22 05 23.12 "Ball Valves for Plumbing Piping" and Section 22 05 23.15 "Gate Valves for Plumbing Piping."
 - 2. Install stops in locations where they can be easily reached for operation.
- D. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- E. Set shower receptors and shower basins in leveling bed of cement grout.
- F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheons requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."
- G. Seal joints between showers and floors and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."

3.3 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."
- C. Comply with traps and soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

- A. Operate and adjust showers and controls. Replace damaged and malfunctioning showers, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

- A. After completing installation of showers and basins, inspect and repair damaged finishes.
- B. Clean showers and basins, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed fixtures and fittings.
- D. Do not allow use of showers and basins for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 23 05 10 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 23.

1.2 SUMMARY

- A. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:
 - 1. Submittals.
 - 2. Coordination drawings.
 - 3. Record documents.
 - 4. Maintenance manuals.
 - 5. Rough-ins.
 - 6. Mechanical installations.
 - 7. Cutting and patching.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 23 Section "BASIC MECHANICAL MATERIALS AND METHODS," for materials and methods common to the remainder of Division 23, plus general related specifications including:
 - a. Access to mechanical installations.

1.3 SUBMITTALS

- A. General: Follow the procedures specified in Division 1 Section "SUBMITTALS."
- B. Increase, by the quantity listed below, the number of mechanical related shop drawings, product data, and samples submitted, to allow for required distribution plus two copies of each submittal required, which will be retained by the Mechanical Consulting Engineer.
 - 1. Shop Drawings - Initial Submittal: 1 additional blue- or black-line prints.
 - 2. Shop Drawings - Final Submittal: 1 additional blue- or black-line prints.
 - 3. Product Data: 1 additional copy of each item.
 - 4. Samples: 1 addition as set.
- C. Additional copies may be required by individual sections of these Specifications.

1.4 RECORD DOCUMENTS

- A. Prepare record documents in accordance with the requirements in Division 1 Section "PROJECT CLOSEOUT." In addition to the requirements specified in Division 1, indicate the following installed conditions:
 - 1. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
 - 2. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
 - 3. Contract Modifications, actual equipment and materials installed.

1.5 MAINTENANCE MANUALS

- A. Prepare maintenance manuals in accordance with Division 1 Section "PROJECT CLOSEOUT." In addition to the requirements specified in Division 1, include the following information for equipment items:
 - 1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
 - 2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
 4. Servicing instructions and lubrication charts and schedules.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.
- 1.7 WARRANTIES
- A. Warranties shall begin at date of final completion. All compressors shall include a minimum of five years warranty. One year warranty for labor, parts, units, etc. is required for all equipment. Additionally, Contractor is responsible for all preventative maintenance and routine service on installed equipment for the one year warranty period in order to maintain all factory/manufacturer warranties.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

3.2 MECHANICAL INSTALLATIONS

- A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:
 1. Coordinate mechanical systems, equipment, and materials installation with other building components.
 2. Verify all dimensions by field measurements.
 3. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 4. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
 5. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
 6. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
 7. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
 8. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
 9. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
 10. Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "ACCESS DOORS" and Division 23 Section "BASIC MECHANICAL MATERIALS AND METHODS."
 11. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.3 CUTTING AND PATCHING

- A. General: Perform cutting and patching in accordance with Division 1 Section "CUTTING AND PATCHING." In addition to the requirements specified in Division 1, the following requirements apply:
 - 1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
- B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
 - 1. Uncover Work to provide for installation of ill-timed Work.
 - 2. Remove and replace defective Work.
 - 3. Remove and replace Work not conforming to requirements of the Contract Documents.
 - 4. Remove samples of installed Work as specified for testing.
 - 5. Install equipment and materials in existing structures.
 - 6. Upon written instructions from the Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.
- C. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by the new Work.
- D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
 - 1. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.
 - 2. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

END OF SECTION

SECTION 23 05 11 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and the Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following basic mechanical materials and methods to complement other Division 23 Sections.
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Concrete equipment base construction requirements.
 - 3. Equipment nameplate data requirements.
 - 4. Labeling and identifying mechanical systems and equipment is specified in Division 23.
 - 5. Nonshrink grout for equipment installations.
 - 6. Field-fabricated metal and wood equipment supports.
 - 7. Installation requirements common to equipment specification Sections.
 - 8. Mechanical demolition.
 - 9. Cutting and patching.
 - 10. Touchup painting and finishing.

1.3 DEFINITIONS

- A. Pipe, pipe fittings, and piping include tube, tube fittings, and tubing.
- B. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
- C. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- D. Exposed Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- E. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- F. Concealed Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.
- B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. When stored inside, do not exceed structural capacity of the floor.
- C. Protect flanges, fittings, and piping specialties from moisture and dirt.

1.5 SEQUENCING AND SCHEDULING

- A. Coordinate mechanical equipment installation with other building components.
- B. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.
- D. Coordinate connection of electrical services.
- E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

- F. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices prior to installing acoustical ceilings and similar concealment.

1.6 WARRANTIES

- A. Warranties shall begin at date of substantial completion. All compressors shall include a minimum of five years warranty. One year warranty for labor, parts, units, etc. is required for all equipment. Additionally, Contractor is responsible for all preventative maintenance and routine service on installed equipment for the one year warranty period in order to maintain all factory/manufacture warranties.

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS

- A. Refer to individual piping system specification Sections for pipe and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

- A. Refer to individual piping system specification Sections in Division 23 for special joining materials not listed below.
- B. Solder Filler Metal: ASTM B 32.
 - 1. Alloy Sn95 or Alloy Sn94: Tin (approximately 95 percent) and silver (approximately 5 percent), having 0.10 percent lead content.
 - 2. Alloy E: Tin (approximately 95 percent) and copper (approximately 5 percent), having 0.10 percent maximum lead content.
 - 3. Alloy HA: Tin-antimony-silver-copper-zinc, having 0.10 percent maximum lead content.
 - 4. Alloy HB: Tin-antimony-silver-copper-nickel, having 0.10 percent maximum lead content.
- C. Brazing Filler Metals: AWS A5.8.
 - 1. BCuP Series: Copper-phosphorus alloys.
 - 2. BAg1: Silver alloy.
- D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- E. Solvent Cements: Manufacturer's standard solvents complying with the following:
 - 1. Chlorinated Poly(Vinyl Chloride) (CPVC): ASTM F 493.
 - 2. Poly(Vinyl Chloride) (PVC): ASTM D 2564.
- F. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.
- G. Couplings: Iron body sleeve assembly, fabricated to match outside diameters of plain-end pressure pipes.
 - 1. Sleeve: ASTM A 126, Class B, gray iron.
 - 2. Followers: ASTM A 47 (ASTM A 47M), Grade 32510 or ASTM A 536 ductile iron.
 - 3. Gaskets: Rubber.
 - 4. Bolts and Nuts: AWWA C111.
 - 5. Finish: Enamel paint.

2.3 IDENTIFYING DEVICES AND LABELS

- A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 23 Sections. Where more than one type is specified for listed application, selection is Installer's option, but provide single selection for each product category.
- B. Equipment Nameplates: Metal nameplate with operational data engraved or stamped, permanently

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

fastened to equipment.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.
 2. Location: An accessible and visible location.
- C. Stencils: Standard stencils, prepared for required applications with letter sizes conforming to recommendations of ASME A13.1 for piping and similar applications, but not less than 1-1/4-inch (30mm) -high letters for ductwork and not less than 3/4-inch (19mm) -high letters for access door signs and similar operational instructions.
1. Material: Brass.
 2. Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.
 3. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ASME A13.1 for colors.
- D. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, lettering, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.

2.4 GROUT

- A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.
1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 2. Design Mix: 5000-psi (34.50MPa), 28-day compressive strength.
 3. Packaging: Premixed and factory-packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS--COMMON REQUIREMENTS

- A. General: Install piping as described below, except where system Sections specify otherwise. Individual piping system specification Sections in Division 23 specify piping installation requirements unique to the piping system.
- B. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, except where deviations to layout are approved on coordination drawings.
- C. Install components having pressure rating equal to or greater than system operating pressure.
- D. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
- E. Install piping free of sags and bends.
- F. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.
- G. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
- H. Install piping to allow application of insulation plus 1-inch (25mm) clearance around insulation.
- I. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
- J. Install fittings for changes in direction and branch connections.
- K. Install couplings according to manufacturer's printed instructions.
- L. Sleeves are not required for core drilled holes.
- M. Permanent sleeves are not required for holes formed by PE plastic (removable) sleeves.
- N. Install sleeves for pipes passing through concrete and masonry walls, concrete floor and roof slabs, and where indicated.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring where specified.
 2. Install large enough sleeves to provide 1/4-inch (6mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than 6 inches (150 mm).
 3. Except for below-grade wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants specified in Division 7 Section "Joint Sealants."
 - O. Above Grade, Exterior Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch (25mm) annular clear space between pipe and sleeve for installation of mechanical seals.
 1. Install steel pipe for sleeves smaller than 6 inches (150 mm).
 2. Install cast-iron wall pipes for sleeves 6 inches (150 mm) and larger.
 3. Assemble and install mechanical seals according to manufacturer's printed instructions.
 - P. Below Grade, Exterior Wall, Pipe Penetrations: Install ductile-iron wall penetration system sleeves according to manufacturer's printed installation instructions.
 - Q. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping sealant material. Firestopping materials are specified in Division 7 Section "Firestopping."
 - R. Verify final equipment locations for roughing in.
 - S. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping system Sections.
 1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 3. Soldered Joints: Construct joints according to AWS "Soldering Manual," Chapter 22 "The Soldering of Pipe and Tube."
 4. Brazed Joints: Construct joints according to AWS "Brazing Manual" in the "Pipe and Tube" chapter.
 5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full inside diameter. Join pipe fittings and valves as follows:
 - a. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
 - b. Apply appropriate tape or thread compound to external pipe threads (except where dry seal threading is specified).
 - c. Align threads at point of assembly.
 - d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
 - e. Damaged Threads: Do not use pipe or pipe fittings having threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
 - T. Piping Connections: Except as otherwise indicated, make piping connections as specified below.
 1. Install unions in piping 2 inches (50 mm) and smaller adjacent to each valve and at final connection to each piece of equipment having a 2-inch (50mm) or smaller threaded pipe connection.
 2. Wet Piping Systems (Water and Steam): Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.
- 3.2 EQUIPMENT INSTALLATION--COMMON REQUIREMENTS
- A. Install equipment to provide the maximum possible headroom where mounting heights are not indicated.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Architect.
- C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.
- D. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
- E. Install equipment giving right-of-way to piping systems installed at a required slope.

3.3 LABELING AND IDENTIFYING

- A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
 - 1. Stenciled Markers: Complying with ASME A13.1.
- B. Equipment: Install engraved plastic laminate sign or equipment marker on or near each major item of mechanical equipment.
 - 1. Lettering Size: Minimum 1/4-inch (6mm) -high lettering for name of unit where viewing distance is less than 2 feet (0.6 m), 1/2-inch (13mm) -high for distances up to 6 feet (1.8 m), and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 to 3/4 of size of principal lettering.
 - 2. Text of Signs: Provide text to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to name of identified unit.
- C. Adjusting: Relocate identifying devices which become visually blocked by work of this Division or other Divisions.

3.4 PAINTING AND FINISHING

- A. Damage and Touch Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 DEMOLITION

- A. Disconnect, demolish, and remove work specified under Division 23 and as indicated.
- B. Where pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.
- C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.
- D. Abandoned Work: Cut and remove buried pipe abandoned in place, 2 inches (50 mm) beyond the face of adjacent construction. Cap and patch surface to match existing finish.
- E. Removal: Remove indicated equipment from the Project site.
- F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.6 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of the trades involved.
- B. Repair cut surfaces to match adjacent surfaces.

3.7 GROUTING

- A. Install nonmetallic nonshrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms for placement of grout, as required.
- D. Avoid air entrapment when placing grout.
- E. Place grout to completely fill equipment bases.
- F. Place grout on concrete bases to provide a smooth bearing surface for equipment.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's printed instructions.

END OF SECTION

SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Premium efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
 - 2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 23 05 17 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.
6. Silicone sealants.

B. Related Requirements:

1. Section 07 84 13 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop collar.
- B. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, anti-corrosion coated or zinc coated, with plain ends and integral welded waterstop collar.
- C. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- D. PVC Pipe Sleeves: ASTM D1785, Schedule 40.
- E. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.
- F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

- A. Description: Manufactured, Dura-coated or Duco-coated galvanized cast-iron sleeve with integral cast flashing flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.

2.3 SLEEVE-SEAL SYSTEMS

A. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Designed to form a hydrostatic seal of 20-psig.
3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size.
4. Pressure Plates: Carbon steel.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B633 of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

- A. Description:
1. Manufactured plastic, sleeve-type, waterstop assembly, made for imbedding in concrete slab or wall.
 2. Plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

- A. Description: Nonshrink, recommended for interior and exterior sealing openings in nonfire-rated walls or floors.
- B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.6 SILICONE SEALANTS

- A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C920, Type S, Grade NS, Class 25, use NT.
1. Verify sealant has a VOC content of 250 g/L or less.
 2. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.
1. Verify sealant has a VOC content of 250 g/L or less.
 2. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
1. Verify sealant has a VOC content of 250 g/L or less.
 2. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
1. Sleeves are not required for core-drilled holes.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
 - 2. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 - 3. Using grout or silicone sealant, seal space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use sealants appropriate for size, depth, and location of joint.
- E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke-Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 07 84 13 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
 - 1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 07 62 00 "Sheet Metal Flashing and Trim."
 - 3. Install section of cast-iron soil pipe to extend sleeve to 3 inches above finished floor level.
 - 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 5. Using waterproof silicone sealant, seal space between top hub of stack-sleeve fitting and pipe.
- B. Fire-Resistance-Rated, Horizontal Assembly, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping specified in Section 07 84 13 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal-system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings as new walls and slabs are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout or silicone sealant, seal space around outside of sleeve-seal fittings.

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
- B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

3.6 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls Above Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron sleeves Sleeve-seal fittings.
 - b. Piping NPS 6 and Larger: Cast-iron pipe sleeves Sleeve-seal fittings.
 - 2. Exterior Concrete Walls Below Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves with sleeve-seal system Sleeve-seal fittings.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 and Larger: Cast-iron pipe sleeves with sleeve-seal system, Steel pipe sleeves with sleeve-seal system, Sleeve-seal fittings.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 3. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves with sleeve-seal system, Steel pipe sleeves with sleeve-seal system, Sleeve-seal fittings.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 and Larger: Cast-iron pipe sleeves with sleeve-seal system, Steel pipe sleeves with sleeve-seal system, Sleeve-seal fittings.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 4. Concrete Slabs Above Grade:
 - a. Piping Smaller Than NPS 6: Steel pipe sleeves, Molded-PE or -PP sleeves, or Molded-PVC sleeves.
 - b. Piping NPS 6 and Larger: Steel pipe sleeves, PVC-pipe sleeves, Stack-sleeve fittings.
 - 5. Interior Partitions:
 - a. Piping Smaller Than NPS 6: Steel pipe sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel sheet sleeves.

END OF SECTION

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Fiberglass pipe hangers.
 - 4. Metal framing systems.
 - 5. Fiberglass strut systems.
 - 6. Thermal-hanger shield inserts.
 - 7. Fastener systems.
 - 8. Pipe stands.
 - 9. Equipment stands.
 - 10. Equipment supports.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Environmental Product Declaration (EPD): For each product.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

2.2 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
 - 3. Nonmetallic Coatings: Plastic coated, or epoxy powder-coated.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Stainless Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
- C. Copper Pipe and Tube Hangers:
1. Description: MSS SP-58, Types 1 through 58, copper-plated steel, factory-fabricated components.
 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-plated steel.
- 2.3 TRAPEZE PIPE HANGERS
- A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.
- 2.4 FIBERGLASS PIPE HANGERS
- A. Clevis-Type, Fiberglass Pipe Hangers:
1. Description: Similar to MSS SP-58, Type 1, factory-fabricated steel pipe hanger except hanger is made of fiberglass or fiberglass-reinforced resin.
- 2.5 METAL FRAMING SYSTEMS
- A. MFMA Manufacturer Metal Framing Systems:
1. Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
 2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 3. Channels: Continuous slotted carbon-steel channel with inturned lips.
 4. Channel Width: Selected for applicable load criteria.
 5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel.
 7. Metallic Coating: No coating.
- B. Non-MFMA Manufacturer Metal Framing Systems:
1. Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
 2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 3. Channels: Continuous slotted carbon-steel channel with inturned lips.
 4. Channel Width: Select for applicable load criteria.
 5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel.
 7. Metallic Coating: No coating.
- 2.6 THERMAL-HANGER SHIELD INSERTS
- A. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100-psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psi minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with 100-psi ASTM C552, Type II cellular glass with 100-psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psi minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.7 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type anchors for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Indoor Applications: Zinc-coated or stainless steel.
 - 2. Outdoor Applications: Stainless steel.

2.8 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand:
 - 1. Description: Single base unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
 - 2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
 - a. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than percent.
 - 3. Hardware: Galvanized steel or polycarbonate.
 - 4. Accessories: Protection pads.
- C. Low-Profile, Single Base, Single-Pipe Stand:
 - 1. Description: Single base with vertical and horizontal members, and pipe support, for roof installation without membrane protection.
 - 2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
 - a. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than Insert value percent.
 - 3. Vertical Members: Two, galvanized-steel, continuous-thread 1/2-inch rods.
 - 4. Horizontal Member: Adjustable horizontal, galvanized-steel pipe support channels.
 - 5. Pipe Supports: Roller.
 - 6. Hardware: Galvanized steel.
 - 7. Accessories: Protection pads.
 - 8. Height: 12 inches above roof.

2.9 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.10 OUTDOOR EQUIPMENT STANDS

- A. Description: Individual foot supports with elevated adjustable channel cross bars and clamps/fasteners/bolts for ground or roof supported outdoor equipment components, without roof membrane penetration, in a pre-fabricated system that can be modularly-assembled on site.
- B. Foot Material: Rubber or polypropylene.
- C. Rails Material: Hot dip galvanized carbon steel.
- D. Wind/Sliding Load Resistance: Up to 150 MPH minimum.

2.11 MATERIALS

- A. Aluminum: ASTM B221.
- B. Carbon Steel: ASTM A1011/A1011M.
- C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; galvanized.
- D. Stainless Steel: ASTM A240/A240M.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- E. Threaded Rods: Continuously threaded. Zinc-plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar materials as rods.
- F. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A36/A36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
 - 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 07 72 00 "Roof Accessories" for curbs.
- G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- N. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
 - 5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in Section 09 91 13 "Exterior Painting" Section 09 91 23 "Interior Painting" and Section 09 96 00 "High-Performance Coatings" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal framing systems and attachments for general service applications.
- F. Use stainless steel pipe hangers and fiberglass pipe hangers and fiberglass strut systems and stainless steel or corrosion-resistant attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper or stainless steel attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
 12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
 17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
 19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is unnecessary.
 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is unnecessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- P. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Duct labels.
 - 5. Stencils.
 - 6. Valve tags.
 - 7. Warning tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: Brass, 0.032-inch aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Letter Color: Black.
 - 3. Background Color: White.
 - 4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 - 6. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch Insert dimension thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: Black.
 - 3. Background Color: Black.
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 7. Fasteners: Stainless-steel rivets or self-tapping screws.
 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch Insert dimension thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Red.
- C. Background Color: White.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 2. Lettering Size: Size letters according to ASME A13.1 for piping At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

2.4 DUCT LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White.
- C. Background Color: Black.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

2.5 STENCILS

- A. Stencils for Piping:
 - 1. Lettering Size: Size letters according to ASME A13.1 for piping At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.
 - 2. Stencil Material: Brass.
 - 3. Stencil Paint: Exterior, gloss, alkyd enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
 - 4. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
- B. Stencils for Ducts:
 - 1. Lettering Size: Minimum letter height of 1-1/4 inches for viewing distances up to 15 feet and proportionately larger lettering for greater viewing distances.
 - 2. Stencil Material: Brass.
 - 3. Stencil Paint: Exterior, gloss, alkyd enamel. Paint may be in pressurized spray-can form.
 - 4. Identification Paint: Exterior, alkyd enamel. Paint may be in pressurized spray-can form.
- C. Stencils for Access Panels and Door Labels, Equipment Labels, and Similar Operational Instructions:
 - 1. Lettering Size: Minimum letter height of 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.
 - 2. Stencil Material: Brass.
 - 3. Stencil Paint: Exterior, gloss, alkyd enamel. Paint may be in pressurized spray-can form.
 - 4. Identification Paint: Exterior, alkyd enamel. Paint may be in pressurized spray-can form.

2.6 VALVE TAGS

- A. Description: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass wire-link chain or beaded chain or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2.7 WARNING TAGS

- A. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.
 - 1. Size: 3 by 5-1/4 inches minimum.
 - 2. Fasteners: Brass grommet and wire.
 - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 - 4. Color: Safety-yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

- A. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.
 - 1. Identification Paint: Use for contrasting background.
 - 2. Stencil Paint: Use for pipe marking.
- B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- D. Pipe Label Color Schedule:
 - 1. Condenser-Water Piping: White letters on a safety-green background.
 - 2. Refrigerant Piping: Black letters on a safety-orange background.

3.5 DUCT LABEL INSTALLATION

- A. Install plastic-laminated self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:
 - 1. Blue: For cold-air supply ducts.
 - 2. Yellow: For hot-air supply ducts.
 - 3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
- B. Stenciled Duct Label Option: Stenciled labels showing service and flow direction may be provided instead of plastic-laminated duct labels, at Installer's option.
- C. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.6 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - 1. Valve-Tag Size and Shape:
 - a. Condenser Water: 1-1/2 inches, round.
 - b. Refrigerant: 1-1/2 inches, round.
 - c. Hot Water: 1-1/2 inches, round.
 - d. Gas: 1-1/2 inches, round.
 - 2. Valve-Tag Colors:
 - a. Toxic and Corrosive Fluids: Black letters on a safety-orange background.
 - b. Flammable Fluids: Black letters on a safety-yellow background.
 - c. Combustible Fluids: White letters on a safety-brown background.
 - d. Potable and Other Water: White letters on a safety-green background.
 - e. Compressed Air: White letters on a safety-blue background.
 - f. Defined by User: White letters on a safety-purple background, black letters on a safety-white background, white letters on a safety-gray background, and white letters on a safety-black background

3.7 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. Related Sections
 - 1. General requirements for testing agencies are specified in the Division-1 Section Quality Control Services.
 - 2. Other Division-23 Sections specify balancing devices and their installation, and materials and installations of mechanical systems.
 - 3. Individual Division-23 system sections specify leak testing requirements and procedures.

1.2 SUMMARY

- A. This Section specifies the requirements and procedures total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.
- B. Test, adjust, and balance the following mechanical systems
 - 1. Supply air systems, all pressure ranges; including variable volume and double duct systems.
 - 2. Return air systems.
 - 3. Exhaust air systems.
 - 4. Verify temperature control system operation.
- C. Test systems for proper sound and vibration levels.
- D. This Section does not include:
 - 1. Testing boilers and pressure vessels for compliance with safety codes;
 - 2. Specifications for materials for patching mechanical systems;
 - 3. Specifications for materials and installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing, refer to the respective system sections for materials and installation requirements.
 - 4. Requirements and procedures for piping and ductwork systems leakage tests.

1.3 DEFINITIONS

- A. Systems testing, adjusting, and balancing is the process of checking and adjusting all the building environmental systems to produce the design objectives. It includes:
 - 1. The balance of air and water distribution;
 - 2. Adjustment of total system to provide design quantities;
 - 3. Electrical measurement;
 - 4. Verification of performance of all equipment and automatic controls;
 - 5. Sound and vibration measurement.
- B. Test: To determine quantitative performance of equipment.
- C. Adjust: To regulate the specified fluid flow rate and air patterns at the terminal equipment (e.g., reduce fan speed, throttling).
- D. Balance: To proportion flows within the distribution system (submains, branches, and terminals) according to specified design quantities.
- E. Procedure: Standardized approach and execution of sequence of work operations to yield reproducible results.
- F. Report forms: Test data sheets arranged for collecting test data in logical order for submission and review. These data should also form the permanent record to be used as the basis for required future testing, adjusting, and balancing.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- G. Terminal: The point where the controlled fluid enters or leaves the distribution system. These are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.
- H. Main: Duct or pipe containing the system's major or entire fluid flow.
- I. Submain: Duct or pipe containing part of the systems' capacity and serving two or more branch mains.
- J. Branch main: Duct or pipe serving two or more terminals.
- K. Branch: Duct or pipe serving a single terminal.

1.4 SUBMITTALS

A. Agency Data

- 1. Submit proof that the proposed testing, adjusting, and balancing agency meets the qualifications specified below.

B. Engineer and Technicians Data:

- 1. Submit proof that the Test and Balance Engineer assigned to supervise the procedures, and the technicians proposed to perform the procedures meet the qualifications specified below.

C. Procedures and Agenda: Submit a synopsis of the testing, adjusting, and balancing procedures and agenda proposed to be used for this project.

D. Maintenance Data: Submit maintenance and operating data that include how to test, adjust, and balance the building systems. Include this information in maintenance data specified in Division 1 and mechanical specifications.

E. Sample Forms: Submit sample forms, if other than those standard forms prepared by the AABC are proposed.

F. Certified Reports: Submit testing, adjusting, and balancing reports bearing the seal and signature of the Test and Balance Engineer. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing, adjusting, and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems. Follow the procedures and format specified below:

- 1. Draft reports: Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on the approved forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit 2 complete sets of draft reports. Only 1 complete set of draft reports will be returned.
- 2. Final Report: Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit 2 complete sets of final reports.
- 3. Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the below listed divisions, separated by divider tabs:
 - a. General Information and Summary
 - b. Air Systems
 - c. Hydronic Systems
 - d. Temperature Control Systems
 - e. Special Systems
 - f. Sound and Vibration Systems
- 4. Report Contents: Provide the following minimum information, forms and data:
 - a. General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, Contractor, Owner, Architect, Engineer, and Project. Include addresses,

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

and contact names and telephone numbers. Also include a certification sheet containing the seal and name address, telephone number, and signature of the Certified Test and Balance Engineer. Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.

- b. The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by the AABC and NEBB, for each respective item and system. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form.
- G. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

1.5 QUALITY ASSURANCE

A. PRE-QUALIFIED CONTRACTORS FOR THIS ROLE.

1. Superior Test & Balance, Inc. (AABC)
1545 Gulf Shores Parkway, PMB #294
Gulf Shores, AL 36542
Tel: 251.317.3088
2. Systems Analysis, Inc. (AABC & NEBB)
217 Oxmoor Circle
Birmingham, AL 35209
Tel: 205.802.7850
3. National True-Test, Inc. (NEBB)
5757 Carrington Lake Parkway
Trussville, AL 35173
Tel: 205.681.9050
4. Environmental Testing Service, Inc. (NEBB)
150 Highway 216
Montevallo, AL 35115
Tel: (205) 476-8640
5. Performance Testing & Balancing Co., Inc. (AABC)
2021 Five Points Road
Cleveland, Alabama 35049
Tel: (205) 559-2773

B. Any Test & Balance Contractors not listed above must be requested and approved in writing ten (10) days prior to the bid.

C. Agency Qualifications

1. Employ the services of an independent testing, adjusting, and balancing agency meeting the qualifications specified below, to be the single source of responsibility to test, adjust, and balance the building mechanical systems identified above, to produce the design objectives. Services shall include checking installations for conformity to design, measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.
2. An independent testing, adjusting, and balancing agency certified by Associated Air Balance Council (AABC) in those testing and balancing disciplines required for this project, and having at least one Professional Engineer registered in the State in which the services are to be performed, certified by AABC as a Test and Balance Engineer.

D. Codes and Standards:

1. NEBB: "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
2. AABC: "National Standards For Total System Balance".

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. ASHRAE: ASHRAE Handbook, 1984 Systems Volume, Chapter 37, Testing, Adjusting, and Balancing.
 - E. Pre-Balancing Conference: Prior to beginning of the testing, adjusting, and balancing procedures, schedule and conduct a conference with the Architect/Engineer and representatives of installers of the mechanical systems. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.
- 1.6 PROJECT CONDITIONS
- A. Systems Operation: Systems shall be fully operational prior to beginning procedures.
- 1.7 SEQUENCING AND SCHEDULING
- A. Test, adjust and balance air conditioning systems during summer season and heating systems during winter season, including at least a period of operation at outside conditions within 5 deg. F wet bulb temperature of maximum summer design condition, and within 10 deg. F dry bulb temperature of minimum winter design condition. Take final temperature readings during seasonal operation.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING

- A. Before operating the system, perform these steps:
 1. Obtain design drawings and specifications and become thoroughly acquainted with the design intent.
 2. Obtain copies of approved shop drawings of all air handling equipment, outlets (supply, return, and exhaust) and temperature control diagrams.
 3. Compare design to installed equipment and field installations.
 4. Walk the system from the system air handling equipment to terminal units to determine variations of installation from design.
 5. Check filters for cleanliness.
 6. Check dampers (both volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.
 7. Prepare report test sheets for both fans and outlets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a crosscheck with required fan volumes.
 8. Determine best locations in main and branch ductwork for most accurate duct traverses.
 9. Place outlet dampers in the full open position.
 10. Prepare schematic diagrams of system "as-built" ductwork and piping layouts to facilitate reporting.
 11. Lubricate all motors and bearings.
 12. Check fan belt tension.
 13. Check fan rotation.

3.2 MEASUREMENTS

- A. Provide all required instrumentation to obtain proper measurements, calibrated to the tolerances specified in the referenced standards. Instruments shall be properly maintained and protected against damage.
- B. Provide instruments meeting the specifications of the referenced standards.
- C. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.
- D. Apply instrument as recommended by the manufacturer.
- E. Use instruments with minimum scale and maximum subdivisions and with scale ranges proper for the value being measured.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- F. When averaging values, take a sufficient quantity of readings which will result in a repeatability error of less than 5 percent. When measuring a single point, repeat readings until 2 consecutive identical values are obtained.
- G. Take all reading with the eye at the level of the indicated value to prevent parallax.
- H. Use pulsation dampeners where necessary to eliminate error involved in estimating average of rapidly fluctuation readings.
- I. Take measurements in the system where best suited to the task.

3.3 PERFORMING TESTING, ADJUSTING, AND BALANCING

- A. Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards.
- B. Cut insulation, ductwork, and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.
- C. Patch insulation, ductwork, and housings, using materials identical to those removed.
- D. Seal ducts and piping, and test for and repair leaks.
- E. Seal insulation to re-establish integrity of the vapor barrier.
- F. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.
- G. Test and Balance Contractor shall run systems through all modes of operation and report any deficiencies. Report shall include complete coil performance for all modes of operation including coil entering and leaving db/wb conditions. Report shall also include outside air temperature and humidity at time of test for each operating mode if applicable.
- H. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

3.4 TESTING FOR SOUND AND VIBRATION

- A. Test and adjust mechanical systems for sound and vibration in accordance with the detailed instructions of the referenced standards.

3.5 RECORD AND REPORT DATA

- A. Record all data obtained during testing, adjusting, and balancing in accordance with, and on the forms recommended by the referenced standards, and as approved on the sample report forms.
- B. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

3.6 DEMONSTRATION

- A. Training
 - 1. Train the Owner's maintenance personnel on troubleshooting procedures and testing, adjusting, and balancing procedures. Review with the Owner's personnel, the information contained in the Operating and Maintenance Data specified in Division 1 and mechanical specifications.
 - 2. Schedule training with Owner through the Architect/Engineer with at least 7 days prior notice.

END OF SECTION

SECTION 23 07 13 - DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes insulating the following duct services:
 1. Indoor, concealed supply and outdoor air.
 2. Indoor, exposed supply and outdoor air.
 3. Indoor, concealed return located in unconditioned space.
 4. Indoor, exposed return located in unconditioned space.
 5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
 6. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
 7. Indoor, concealed oven and warewash exhaust.
 8. Indoor, exposed oven and warewash exhaust.
 9. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
 10. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
 11. Outdoor, concealed supply and return.
 12. Outdoor, exposed supply and return.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).
- B. Sustainable Design Submittals:
 1. Product Data: For adhesives, indicating VOC content.
 2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
 3. Product Data: For coatings, indicating VOC content.
 4. Laboratory Test Reports: For coatings, indicating compliance with requirements for low-emitting materials.
 5. Product Data: For sealants, indicating VOC content.
 6. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
 3. Detail application of field-applied jackets.
 4. Detail application at linkages of control devices.
- D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:
 1. Sheet Form Insulation Materials: 12 inches square.
 2. Sheet Jacket Materials: 12 inches square.
 3. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534, Type II for sheet materials.
- G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C553, Type II and ASTM C1290, Type II with factory-applied vinyl jacket, Type III with factory-applied FSK jacket, Type III with factory-applied FSP jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- H. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ or with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- I. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- J. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C534 or ASTM C1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.

2.2 FIRE-RATED INSULATION SYSTEMS

- A. Fire-Rated Board: Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to 1700 deg F. Comply with ASTM C656, Type II, Grade 6. Tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.
- B. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. Verify adhesives have a VOC content of 50 g/L or less.
 - 2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Verify fiberglass adhesive has a VOC content of 80 g/L or less when calculated in accordance with 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Verify adhesive has a VOC content of 80 g/L or less when calculated in accordance with 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
 - 1. Verify adhesive has a VOC content of 80 g/L or less when calculated in accordance with 40 CFR 59, Subpart D (EPA Method 24).

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.4 MASTICS AND COATINGS

- A. Materials shall be compatible with insulation materials, jackets, and substrates.
 1. VOC Content: 300 g/L or less.
 2. Low-Emitting Materials: Verify mastic coatings comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Vapor-Retarder Mastic: Water based; suitable for indoor use on below ambient services.
 1. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 3. Comply with MIL-PRF-19565C, Type II, for permeance requirements.
 4. Color: White.
- C. Vapor-Retarder Mastic: Solvent based; suitable for indoor use on below ambient services.
 1. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
 2. Service Temperature Range: 0 to 180 deg F.
 3. Color: White.
- D. Vapor-Retarder Mastic: Solvent based; suitable for outdoor use on below ambient services.
 1. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
 2. Service Temperature Range: Minus 50 to plus 220 deg F.
 3. Color: White.
- E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
 1. Water-Vapor Permeance: ASTM E96, greater than 1.0 perm at manufacturer's recommended dry film thickness.
 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 3. Color: White.

2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
 1. Verify adhesives have a VOC content of 50 g/L or less.
 2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
 4. Service Temperature Range: 0 to plus 180 deg F.
 5. Color: White.

2.6 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 2. Fire- and water-resistant, flexible, elastomeric sealant.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.
5. Verify sealant has a VOC content of 420 g/L or less.
6. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. Verify sealant has a VOC content of 420 g/L or less.
6. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C1136, Type II.
5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E96/E96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Glass-Fiber Fabric: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. in. for covering ducts.
- B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for ducts.

2.9 FIELD-APPLIED CLOTHS

- A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

2.10 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 1. Adhesive: As recommended by jacket material manufacturer.
 2. Color: White.
- D. Metal Jacket:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Factory cut and rolled to size.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
 - d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
 2. Stainless-Steel Jacket: ASTM A167 or ASTM A240/A240M.
 - a. Factory cut and rolled to size.
 - b. Material, finish, and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
 - d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
- E. Self-Adhesive Outdoor Jacket: 60-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with white aluminum-foil facing.
- 2.11 TAPES
- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
 1. Width: 3 inches.
 2. Thickness: 11.5 mils.
 3. Adhesion: 90 ounces force/inch in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: 40 lbf/inch in width.
 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
 - B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.
 1. Width: 3 inches.
 2. Thickness: 6.5 mils.
 3. Adhesion: 90 ounces force/inch in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: 40 lbf/inch in width.
 6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
 - C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
 1. Width: 2 inches.
 2. Thickness: 6 mils.
 3. Adhesion: 64 ounces force/inch in width.
 4. Elongation: 500 percent.
 5. Tensile Strength: 18 lbf/inch in width.
 - D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 1. Width: 2 inches.
 2. Thickness: 3.7 mils.
 3. Adhesion: 100 ounces force/inch in width.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

2.12 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A167 or ASTM A240/A240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing seal or closed seal.
2. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
 - b. Spindle: Nylon, 0.106-inch-diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
 - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive-backed base with a peel-off protective cover.
6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- 7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
 - D. Wire: 0.062-inch soft-annealed, stainless steel.
- 2.13 CORNER ANGLES
- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D1784, Class 16354-C. White or color-coded to match adjacent surface.
 - B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.
 - C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A167 or ASTM A240/A240M, Type 304 or Type 316.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- 3.4 PENETRATIONS
- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
1. Comply with requirements in Section 07 84 13 "Penetration Firestopping."
- E. Insulation Installation at Floor Penetrations:
1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07 84 13 "Penetration Firestopping."
- 3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION
- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- 3.6 INSTALLATION OF MINERAL-FIBER INSULATION
- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
 5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
 6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
 - B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.7 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
 1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
 2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
 1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
 - 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

- D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.8 FIRE-RATED INSULATION SYSTEM INSTALLATION

- A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
- B. Insulate duct access panels and doors to achieve same fire rating as duct.
- C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 07 84 13 "Penetration Firestopping."

3.9 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
 - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, exposed supply and outdoor air.
 - 3. Indoor, concealed return located in unconditioned space.
 - 4. Indoor, exposed return located in unconditioned space.
 - 5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
 - 6. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
 - 7. Indoor, concealed oven and warewash exhaust.
 - 8. Indoor, exposed oven and warewash exhaust.
 - 9. Indoor, concealed exhaust between isolation damper and penetration of building exterior.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

10. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
11. Outdoor, concealed supply and return.
12. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.12 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, round and flat-oval, supply-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

B. Concealed, round and flat-oval, return-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

C. Concealed, round and flat-oval, outdoor-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

D. Concealed, round and flat-oval, exhaust-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

E. Concealed, rectangular, supply-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

F. Concealed, rectangular, return-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

G. Concealed, rectangular, outdoor-air duct insulation shall be one of the following:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 4. Polyolefin: 1 inch thick.
- H. Concealed, rectangular, exhaust-air duct insulation between isolation damper and penetration of building exterior shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 4. Polyolefin: 1 inch thick.
- I. Concealed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket or board; thickness as required to achieve 2-hour fire rating.
- J. Concealed, supply-air plenum insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 4. Polyolefin: 1 inch thick.
- K. Concealed, return-air plenum insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 4. Polyolefin: 1 inch thick.
- L. Concealed, outdoor-air plenum insulation shall be one of the following:
1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
- M. Concealed, exhaust-air plenum insulation shall be one of the following:
1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
- N. Exposed, round and flat-oval, supply-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 4. Mineral-Fiber Pipe and Tank: 1-1/2 inches thick.
 5. Polyolefin: 1 inch thick.
- O. Exposed, round and flat-oval, return-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 4. Mineral-Fiber Pipe and Tank: 1-1/2 inches thick.
 5. Polyolefin: 1 inch thick.
- P. Exposed, round and flat-oval, outdoor-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

4. Mineral-Fiber Pipe and Tank: 1-1/2 inches thick.
 5. Polyolefin: 1 inch thick.
- Q. Exposed, round and flat-oval, exhaust-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 4. Mineral-Fiber Pipe and Tank: 1-1/2 inches thick.
 5. Polyolefin: 1 inch thick.
- R. Exposed, rectangular, supply-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 4. Polyolefin: 1 inch thick.
- S. Exposed, rectangular, return-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 4. Polyolefin: 1 inch thick.
- T. Exposed, rectangular, outdoor-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 4. Polyolefin: 1 inch thick.
- U. Exposed, rectangular, exhaust-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 4. Polyolefin: 1 inch thick.
- V. Exposed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket or board; thickness as required to achieve 2-hour fire rating.
- W. Exposed, supply-air plenum insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 4. Polyolefin: 1 inch thick.
- X. Exposed, return-air plenum insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
 4. Polyolefin: 1 inch thick.
- Y. Exposed, outdoor-air plenum insulation shall be one of the following:
1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
 2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
- Z. Exposed, exhaust-air plenum insulation shall be one of the following:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.

3.13 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.
- B. Concealed, round and flat-oval, supply-air duct insulation shall be one of the following:
 1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
 2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
- C. Concealed, round and flat-oval, return-air duct insulation shall be one of the following:
 1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
 2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
- D. Concealed, round and flat-oval, outdoor-air duct insulation shall be one of the following:
 1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
 2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
- E. Concealed, rectangular, supply-air duct insulation shall be one of the following:
 1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
 2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
- F. Concealed, rectangular, return-air duct insulation shall be one of the following:
 1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
 2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
- G. Concealed, supply-air plenum insulation shall be one of the following:
 1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. 1.5-lb/cu. ft. nominal density.
 2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
- H. Concealed, return-air plenum insulation shall be one of the following:
 1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
 2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
- I. Exposed, round and flat-oval, supply-air duct insulation shall be one of the following:
 1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
 2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
 3. Mineral-Fiber Pipe and Tank: 1-1/2 inches thick.
- J. Exposed, round and flat-oval, return-air duct insulation shall be one of the following:
 1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
 2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
- K. Exposed, rectangular, supply-air duct insulation shall be one of the following:
 1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
 2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
- L. Exposed, rectangular, return-air duct insulation shall be one of the following:
 1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
 2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
- M. Exposed, supply-air plenum insulation shall be one of the following:
 1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
 2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
- N. Exposed, return-air plenum insulation shall be one of the following:
 1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. 1.5-lb/cu. ft. nominal density.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.

3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Ducts and Plenums, Concealed:
 - 1. Aluminum, Smooth: 0.020 inch thick.
- D. Ducts and Plenums, Exposed:
 - 1. Aluminum, Smooth: 0.020 inch thick.

3.15 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Ducts and Plenums, Concealed:
 - 1. Aluminum, Smooth: 0.020 inch thick.
- D. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
 - 1. Aluminum, Smooth: 0.024 inch thick.
- E. Ducts and Plenums, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:
 - 1. Stainless Steel, Type 304 or Type 316, Smooth, with: 0.020 inch thick.

END OF SECTION

SECTION 23 23 00 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes refrigerant piping used for air-conditioning applications.

1.3 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-410A:
 - 1. Suction Lines for Air-Conditioning Applications: 300 psig.
 - 2. Suction Lines for Heat-Pump Applications: 535 psig.
 - 3. Hot-Gas and Liquid Lines: 535 psig.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:
 - 1. Thermostatic expansion valves.
 - 2. Solenoid valves.
 - 3. Hot-gas bypass valves.
 - 4. Filter dryers.
 - 5. Strainers.
 - 6. Pressure-regulating valves.
- B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
 - 1. Shop Drawing Scale: 1/4 inch equals 1 foot.
 - 2. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.8 PRODUCT STORAGE AND HANDLING

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1.9 COORDINATION

- A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 07720 "Roof Accessories."

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 88, Type K or LASTM B 280, Type ACR.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- E. Brazing Filler Metals: AWS A5.8.
- F. Flexible Connectors:
 - 1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
 - 2. End Connections: Socket ends.
 - 3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
 - 4. Pressure Rating: Factory test at minimum 500 psig.
 - 5. Maximum Operating Temperature: 250 deg F.

2.2 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; Type, Grade, and wall thickness as selected in Part 3 piping applications articles.
- B. Wrought-Steel Fittings: ASTM A 234/A 234M, for welded joints.
- C. Steel Flanges and Flanged Fittings: ASME B16.5, steel, including bolts, nuts, and gaskets, bevel-welded end connection, and raised face.
- D. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- E. Flanged Unions:
 - 1. Body: Forged-steel flanges for NPS 1 to NPS 1-1/2 and ductile iron for NPS 2 to NPS 3. Apply rust-resistant finish at factory.
 - 2. Gasket: Fiber asbestos free.
 - 3. Fasteners: Four plated-steel bolts, with silicon bronze nuts. Apply rust-resistant finish at factory.
 - 4. End Connections: Brass tailpiece adapters for solder-end connections to copper tubing.
 - 5. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
 - 6. Pressure Rating: Factory test at minimum 400 psig.
 - 7. Maximum Operating Temperature: 330 deg F.
- F. Flexible Connectors:
 - 1. Body: Stainless-steel bellows with woven, flexible, stainless-steel-wire-reinforced protective jacket
 - 2. End Connections:
 - a. NPS 2 and Smaller: With threaded-end connections.
 - b. NPS 2-1/2 and Larger: With flanged-end connections.
 - 3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

4. Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

2.3 VALVES AND SPECIALTIES

A. Diaphragm Packless Valves:

1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
3. Operator: Rising stem and hand wheel.
4. Seat: Nylon.
5. End Connections: Socket, union, or flanged.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

B. Packed-Angle Valves:

1. Body and Bonnet: Forged brass or cast bronze.
2. Packing: Molded stem, back seating, and replaceable under pressure.
3. Operator: Rising stem.
4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
5. Seal Cap: Forged-brass or valox hex cap.
6. End Connections: Socket, union, threaded, or flanged.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 275 deg F.

C. Check Valves:

1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
3. Piston: Removable polytetrafluoroethylene seat.
4. Closing Spring: Stainless steel.
5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
6. End Connections: Socket, union, threaded, or flanged.
7. Maximum Opening Pressure: 0.50 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 275 deg F.

D. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig.

E. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.

1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and ac coil.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

6. Working Pressure Rating: 400 psig.
 7. Maximum Operating Temperature: 240 deg F.
 8. Manual operator.
- F. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
 2. Piston, Closing Spring, and Seat Insert: Stainless steel.
 3. Seat Disc: Polytetrafluoroethylene.
 4. End Connections: Threaded.
 5. Working Pressure Rating: 400 psig.
 6. Maximum Operating Temperature: 240 deg F.
- G. Thermostatic Expansion Valves: Comply with ARI 750.
1. Body, Bonnet, and Seal Cap: Forged brass or steel.
 2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
 3. Packing and Gaskets: Non-asbestos.
 4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
 5. Suction Temperature: 40 deg F.
 6. Superheat: Adjustable.
 7. Reverse-flow option (for heat-pump applications).
 8. End Connections: Socket, flare, or threaded union.
 9. Working Pressure Rating: 700 psig.
- H. Hot-Gas Bypass Valves: Comply with UL 429; listed and labeled by an NRTL.
1. Body, Bonnet, and Seal Cap: Ductile iron or steel.
 2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
 3. Packing and Gaskets: Non-asbestos.
 4. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
 5. Seat: Polytetrafluoroethylene.
 6. Equalizer: Internal.
 7. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and ac coil.
 8. End Connections: Socket.
 9. Throttling Range: Maximum 5 psig.
 10. Working Pressure Rating: 500 psig.
 11. Maximum Operating Temperature: 240 deg F.
- I. Straight-Type Strainers:
1. Body: Welded steel with corrosion-resistant coating.
 2. Screen: 100-mesh stainless steel.
 3. End Connections: Socket or flare.
 4. Working Pressure Rating: 500 psig.
 5. Maximum Operating Temperature: 275 deg F.
- J. Angle-Type Strainers:
1. Body: Forged brass or cast bronze.
 2. Drain Plug: Brass hex plug.
 3. Screen: 100-mesh monel.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

4. End Connections: Socket or flare.
 5. Working Pressure Rating: 500 psig.
 6. Maximum Operating Temperature: 275 deg F.
- K. Moisture/Liquid Indicators:
1. Body: Forged brass.
 2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
 3. Indicator: Color coded to show moisture content in ppm.
 4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
 5. End Connections: Socket or flare.
 6. Working Pressure Rating: 500 psig.
 7. Maximum Operating Temperature: 240 deg F.
- L. Replaceable-Core Filter Dryers: Comply with ARI 730.
1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
 2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
 3. Desiccant Media: Activated alumina.
 4. Designed for reverse flow (for heat-pump applications).
 5. End Connections: Socket.
 6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
 7. Maximum Pressure Loss: 2 psig.
 8. Rated Flow: Based upon HVAC tons of refrigeration.
 9. Working Pressure Rating: 500 psig.
 10. Maximum Operating Temperature: 240 deg F.
- M. Permanent Filter Dryers: Comply with ARI 730.
1. Body and Cover: Painted-steel shell.
 2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
 3. Desiccant Media: Activated alumina.
 4. Designed for reverse flow (for heat-pump applications).
 5. End Connections: Socket.
 6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
 7. Maximum Pressure Loss: 2 psig.
 8. Rated Flow: Based upon HVAC tons of refrigeration.
 9. Working Pressure Rating: 500 psig.
 10. Maximum Operating Temperature: 240 deg F.
- N. Mufflers:
1. Body: Welded steel with corrosion-resistant coating.
 2. End Connections: Socket or flare.
 3. Working Pressure Rating: 500 psig.
 4. Maximum Operating Temperature: 275 deg F.
- O. Receivers: Comply with ARI 495.
1. Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
 2. Comply with UL 207; listed and labeled by an NRTL.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Body: Welded steel with corrosion-resistant coating.
 4. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.
 5. End Connections: Socket or threaded.
 6. Working Pressure Rating: 500 psig.
 7. Maximum Operating Temperature: 275 deg F.
- P. Liquid Accumulators: Comply with ARI 495.
1. Body: Welded steel with corrosion-resistant coating.
 2. End Connections: Socket or threaded.
 3. Working Pressure Rating: 500 psig.
 4. Maximum Operating Temperature: 275 deg F.

2.4 REFRIGERANTS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Atofina Chemicals, Inc.
 2. DuPont Company; Fluorochemicals Div.
 3. Honeywell, Inc.; Genetron Refrigerants.
 4. INEOS Fluor Americas LLC.
- C. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

- A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.
- B. Suction Lines NPS 3-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
- C. Suction Lines NPS 4 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with soldered joints.
- D. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
- E. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications:
1. NPS 5/8 and Smaller: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
 2. NPS 3/4 to NPS 1 and Smaller: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
 3. NPS 1-1/4 and Smaller: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.
 4. NPS 1-1/2 to NPS 2: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.
- F. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications NPS 2 to NPS 4: Schedule 40, black-steel and wrought-steel fittings with welded joints.
- G. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
- H. Safety-Relief-Valve Discharge Piping: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
- I. Safety-Relief-Valve Discharge Piping:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. NPS 5/8 and Smaller: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
 2. NPS 3/4 to NPS 1 and Smaller: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
 3. NPS 1-1/4 and Smaller: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.
 4. NPS 1-1/2 to NPS 2: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.
- J. Safety-Relief-Valve Discharge Piping NPS 2 to NPS 4: Schedule 40, black-steel and wrought-steel fittings with welded joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

- A. Install diaphragm packless valves in suction and discharge lines of compressor.
- B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.
- C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.
- D. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.
- E. Install a full-sized, three-valve bypass around filter dryers.
- F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.
- G. Install thermostatic expansion valves as close as possible to distributors on evaporators.
 1. Install valve so diaphragm case is warmer than bulb.
 2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
 3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.
- H. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.
- I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.
- J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected:
 1. Solenoid valves.
 2. Thermostatic expansion valves.
 3. Hot-gas bypass valves.
 4. Compressor.
- K. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.
- L. Install receivers sized to accommodate pump-down charge.
- M. Install flexible connectors at compressors.

3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Refer to drawings and specifications for solenoid valve controllers, control wiring, and sequence of operation.
- K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 08311 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- M. Install refrigerant piping in protective conduit where installed belowground.
- N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- O. Slope refrigerant piping as follows:
 - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
 - 2. Install horizontal suction lines with a uniform slope downward to compressor.
 - 3. Install traps and double risers to entrain oil in vertical runs.
 - 4. Liquid lines may be installed level.
- P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- Q. Before installation of steel refrigerant piping, clean pipe and fittings using the following procedures:
 - 1. Shot blast the interior of piping.
 - 2. Remove coarse particles of dirt and dust by drawing a clean, lintless cloth through tubing by means of a wire or electrician's tape.
 - 3. Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.
 - 4. Draw a clean, lintless cloth, saturated with compressor oil, squeezed dry, through the tube or pipe to remove remaining lint. Inspect tube or pipe visually for remaining dirt and lint.
 - 5. Finally, draw a clean, dry, lintless cloth through the tube or pipe.
 - 6. Safety-relief-valve discharge piping is not required to be cleaned but is required to be open to allow unrestricted flow.
- R. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- S. Identify refrigerant piping and valves according to specifications.
- T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified.
- U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified.

3.4 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.
- D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
 - 1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
 - 2. Use Type BA_g, cadmium-free silver alloy for joining copper with bronze or steel.
- F. Threaded Joints: Thread steel pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry-seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Steel pipe can be threaded, but threaded joints must be seal brazed or seal welded.
- H. Welded Joints: Construct joints according to AWS D10.12/D10.12M.
- I. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.5 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
 - 2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
 - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
 - 4. Spring hangers to support vertical runs.
 - 5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 - 2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 - 3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
 - 4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
 - 9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.
- D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
 - 2. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.

4. NPS 4: Maximum span, 14 feet; minimum rod size, 1/2 inch.

E. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.

2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.

3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.

a. Fill system with nitrogen to the required test pressure.

b. System shall maintain test pressure at the manifold gage throughout duration of test.

c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.

d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.

2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.

3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.

4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.

2. Verify that compressor oil level is correct.

3. Open compressor suction and discharge valves.

4. Open refrigerant valves except bypass valves that are used for other purposes.

5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION

SECTION 23 31 13 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Double-wall rectangular ducts and fittings.
3. Single-wall round ducts and fittings.
4. Double-wall round ducts and fittings.
5. Sheet metal materials.
6. Duct liner.
7. Sealants and gaskets.
8. Hangers and supports.
9. Seismic-restraint devices.

B. Related Sections:

1. Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 23 31 16 "Nonmetal Ducts" for fibrous-glass ducts, thermoset fiber-reinforced plastic ducts, thermoplastic ducts, PVC ducts, and concrete ducts.
3. Section 23 33 00 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Seismic-restraint devices.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
3. Product Data: For sealants, indicating VOC content.
4. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
5. Laboratory Test Reports: For antimicrobial coatings, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top and bottom of ducts.
5. Dimensions of main all duct runs from building grid lines.
6. Fittings.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: A single set of plans or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.
- B. Welding certificates.
- C. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
 3. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for duct joint and seam welding.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."
- C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
- D. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
 1. Construct ducts of galvanized sheet steel unless otherwise indicated.
 2. For ducts exposed to weather, construct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.
- B. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
 2. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.
 3. Where specified for specific applications, all joints shall be welded.
- C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-

support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Where specified for specific applications, all joints shall be welded.

- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. Rectangular Ducts: Fabricate ducts with indicated dimensions for clear internal dimensions of the inner duct.

- B. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.

2. For ducts exposed to weather, construct outer duct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.

- C. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.

2. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.

3. Where specified for specific applications, all joints shall be welded.

- D. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Where specified for specific applications, all joints shall be welded.

- E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.

3. Coat insulation with antimicrobial coating.

4. Cover insulation with polyester film complying with UL 181, Class 1.

- F. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C534/C534M, Type II for sheet materials, and with NFPA 90A or NFPA 90B.

1. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2.4 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. For ducts exposed to weather, construct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.
- B. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
- D. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.5 DOUBLE-WALL ROUND DUCTS AND FITTINGS

- A. Round: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.
1. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.
 - a. Construct ducts of galvanized sheet steel unless otherwise indicated.
 - b. For ducts exposed to weather, construct outer duct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.
 2. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - a. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
 3. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - a. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
 - b. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
 4. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Inner Duct: solid galvanized sheet steel.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- C. Interstitial Insulation: Fibrous-glass liner complying with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - 1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - 2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
 - 3. Coat insulation with antimicrobial coating.
 - 4. Cover insulation with polyester film complying with UL 181, Class 1.
- D. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C534/C534M, Type II for sheet materials, and with NFPA 90A or NFPA 90B.
 - 1. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2.6 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
 - 1. Galvanized Coating Designation: G60.
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. PVC-Coated, Galvanized Sheet Steel: Comply with ASTM A653/A653M.
 - 1. Galvanized Coating Designation: G60.
- D. Carbon-Steel Sheets: Comply with ASTM A1008/A1008M, with oiled, matte finish for exposed ducts.
- E. Stainless-Steel Sheets: Comply with ASTM A480/A480M, Type 304 or 316, as indicated in "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in "Duct Schedule" Article.
- F. Aluminum Sheets: Comply with ASTM B209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- G. Reinforcement Shapes and Plates: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- H. Tie Rods: Galvanized steel, 1/4-inch-minimum diameter for lengths 36 inches or less; 3/8-inch-minimum diameter for lengths longer than 36 inches.

2.7 DUCT LINER

- A. Fibrous-Glass Duct Liner: Comply with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - 1. Maximum Thermal Conductivity:
 - a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - 2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
 - 3. Solvent-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C916.
 - a. Adhesive shall have a VOC content of 80 g/L or less.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- b. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C534/C534M, Type II, Grade 1; and with NFPA 90A or NFPA 90B.
 1. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
 2. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
 - a. Adhesive shall have a VOC content of 80 g/L or less.
 - b. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Fiberglass-Free Duct Liner: Made from partially recycled cotton or polyester products and containing no fiberglass. Airstream surface overlaid with fire-resistant facing to prevent surface erosion by airstream, complying with NFPA 90A or NFPA 90B. Treat natural-fiber products with antimicrobial coating.
 1. Maximum Thermal Conductivity: 0.24 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature when tested in accordance with ASTM C518.
 2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with ASTM E84; certified by an NRTL.
 3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
 - a. Adhesive shall have a VOC content of 80 g/L or less.
 - b. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. Insulation Pins and Washers:
 1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick aluminum; with beveled edge sized as required to hold insulation securely in place, but not less than 1-1/2 inches in diameter.
- E. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."
 1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
 2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
 3. Butt transverse joints without gaps, and coat joint with adhesive.
 4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
 5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm or greater.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - a. Fan discharges.
 - b. Intervals of lined duct preceding unlined duct.
 - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
 - a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.
10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.8 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 2. Tape Width: 6 inches.
 3. Sealant: Modified styrene acrylic.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. Maximum Static-Pressure Class: 10 inch wg, positive and negative.
 7. Service: Indoor and outdoor.
 8. Service Temperature: Minus 40 to plus 200 deg F.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
 10. Sealant shall have a VOC content of 420 g/L or less.
 11. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Water-Based Joint and Seam Sealant:
 1. Application Method: Brush on.
 2. Solids Content: Minimum 65 percent.
 3. Shore A Hardness: Minimum 20.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. VOC: Maximum 75 g/L (less water).

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

7. Maximum Static-Pressure Class: 10 inch wg, positive and negative.
 8. Service: Indoor or outdoor.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Solvent-Based Joint and Seam Sealant:
1. Application Method: Brush on.
 2. Base: Synthetic rubber resin.
 3. Solvent: Toluene and heptane.
 4. Solids Content: Minimum 60 percent.
 5. Shore A Hardness: Minimum 60.
 6. Water resistant.
 7. Mold and mildew resistant.
 8. Sealant shall have a VOC content of 420 g/L or less.
 9. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 10. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
 11. Service: Indoor or outdoor.
 12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- E. Flanged Joint Sealant: Comply with ASTM C920.
1. General: Single-component, acid-curing, silicone, elastomeric.
 2. Type: S.
 3. Grade: NS.
 4. Class: 25.
 5. Use: O.
 6. Sealant shall have a VOC content of 420 g/L or less.
 7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- G. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
 2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
 3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.
- 2.9 HANGERS AND SUPPORTS
- A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.
 - B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
 - C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
 - D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A492.
- F. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.10 SEISMIC-RESTRAINT DEVICES

- A. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of the ICC Evaluation Service.
 - 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- B. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.
- C. Restraint Cables: ASTM A603, galvanized or ASTM A492, stainless-steel cables with end connections made of galvanized-steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.
- D. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
- E. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested in accordance with ASTM E488/E488M.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.
- B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install ducts in maximum practical lengths with fewest possible joints.
- D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- J. Install fire, combination fire/smoke, and smoke dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction. Comply with requirements in Section 23 33 00 "Air Duct Accessories" for fire and smoke dampers and specific installation requirements of the damper UL listing.
 - K. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.
 - L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."
 - M. Elbows: Use long-radius elbows wherever they fit.
 - 1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
 - 2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.
 - N. Branch Connections: Use lateral or conical branch connections.
- 3.2 INSTALLATION OF EXPOSED DUCTWORK
- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
 - B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
 - C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
 - D. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
 - E. Repair or replace damaged sections and finished work that does not comply with these requirements.
- 3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR TYPE 1 COMMERCIAL KITCHEN GREASE HOOD EXHAUST DUCT
- A. Install ducts in accordance with NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operation"; SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; and SMACNA's "Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines" unless otherwise indicated.
 - B. Install all ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.
 - C. All joints shall be welded and shall be telescoping, bell, or flange joint as per NFPA 96.
 - D. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 20 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings.
 - E. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.
- 3.4 ADDITIONAL INSTALLATION REQUIREMENTS FOR EXHAUST DUCTS SERVING COMMERCIAL DISHWASHERS AND OTHER HIGH-HUMIDITY LOCATIONS
- A. Install dishwasher exhaust ducts and other exhaust ducts from wet, high-humidity locations without dips and traps that may hold water. Slope ducts a minimum of 2 percent back to dishwasher or toward drain.
 - B. Provide a drain pocket at each low point and at the base of each riser with a 1-inch trapped copper drain from each drain pocket to open site floor drain.
 - C. Minimize number of transverse seams.
 - D. Do not locate longitudinal seams on bottom of duct.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3.5 DUCTWORK EXPOSED TO WEATHER

- A. All external joints are to be welded have secure watertight mechanical connections. Seal all openings to provide weatherproof construction.
- B. Construct ductwork to resist external loads of wind, snow, ice, and other effects of weather. Provide necessary supporting structures.
- C. Single Wall:
 - 1. Ductwork shall be Type 304 stainless steel.
 - a. If duct outer surface is uninsulated, protect outer surface with suitable paint. Paint materials and application requirements are specified in Section 09 91 13 "Exterior Painting."
 - 2. Where ducts have external insulation, provide weatherproof aluminum jacket. See Section 23 07 13 "Duct Insulation."
- D. Double Wall:
 - 1. Ductwork shall comply with requirements in "Double-Wall Rectangular Ducts and Fittings" or "Double-Wall Round Ducts and Fittings" Article.
 - 2. Ductwork outer wall shall be Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.
 - 3. Provide interstitial insulation.

3.6 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts at a minimum to the following seal classes in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 2. Outdoor, Supply-Air Ducts: Seal Class A.
 - 3. Outdoor, Exhaust Ducts: Seal Class C.
 - 4. Outdoor, Return-Air Ducts: Seal Class C.
 - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
 - 6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
 - 7. Unconditioned Space, Exhaust Ducts: Seal Class C.
 - 8. Unconditioned Space, Return-Air Ducts: Seal Class B.
 - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
 - 10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
 - 11. Conditioned Space, Exhaust Ducts: Seal Class B.
 - 12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.7 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- 3.8 CONNECTIONS
- A. Make connections to equipment with flexible connectors complying with Section 23 33 00 "Air Duct Accessories."
 - B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.
- 3.9 PAINTING
- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
- 3.10 FIELD QUALITY CONTROL
- A. Perform tests and inspections.
 - B. Leakage Tests:
 1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 2. Test the following systems:
 - a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections totaling no less than 25 percent of total installed duct area for each designated pressure class.
 - b. Supply Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - c. Return Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - d. Exhaust Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - e. Outdoor-Air Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.
 3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

4. Testing of each duct section is to be performed with access doors, coils, filters, dampers, and other duct-mounted devices in place as designed. No devices are to be removed or blanked off so as to reduce or prevent additional leakage.
 5. Test for leaks before applying external insulation.
 6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
 7. Give seven days' advance notice for testing.
- C. Duct System Cleanliness Tests:
1. Visually inspect duct system to ensure that no visible contaminants are present.
 2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness in accordance with "Description of Method 3 - NADCA Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
 - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.
- 3.11 DUCT CLEANING
- A. Clean new duct system(s) before testing, adjusting, and balancing.
- B. For cleaning of existing ductwork, see Section 23 01 30.52 "Existing HVAC Air Distribution System Cleaning."
- C. Use duct cleaning methodology as indicated in NADCA ACR.
- D. Use service openings for entry and inspection.
1. Provide openings with access panels appropriate for duct static-pressure and leakage class at dampers, coils, and any other locations where required for inspection and cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 23 33 00 "Air Duct Accessories" for access panels and doors.
 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 3. Remove and reinstall ceiling to gain access during the cleaning process.
- E. Particulate Collection and Odor Control:
1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
 2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
- F. Clean the following components by removing surface contaminants and deposits:
1. Air outlets and inlets (registers, grilles, and diffusers).
 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
 4. Coils and related components.
 5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
 6. Supply-air ducts, dampers, actuators, and turning vanes.
 7. Dedicated exhaust and ventilation components and makeup air systems.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

G. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans in accordance with NADCA ACR. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents in accordance with manufacturer's written instructions after removal of surface deposits and debris.

3.12 STARTUP

- A. Air Balance: Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC."

3.13 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

- a. Pressure Class: Positive 2-inch wg.
- b. Minimum SMACNA Seal Class: A.
- c. SMACNA Leakage Class for Rectangular: 2.
- d. SMACNA Leakage Class for Round and Flat Oval: 2.

2. Ducts Connected to Constant-Volume Air-Handling Units:

- a. Pressure Class: Positive 2-inch wg.
- b. Minimum SMACNA Seal Class: A.
- c. SMACNA Leakage Class for Rectangular: 2.
- d. SMACNA Leakage Class for Round and Flat Oval: 2.

3. Ducts Connected to Variable-Air-Volume Air-Handling Units:

- a. Pressure Class: Positive 3-inch wg.
- b. Minimum SMACNA Seal Class: A.
- c. SMACNA Leakage Class for Rectangular: 2.
- d. SMACNA Leakage Class for Round and Flat Oval: 2.

4. Ducts Connected to Equipment Not Listed Above:

- a. Pressure Class: Positive 2-inch wg.
- b. Minimum SMACNA Seal Class: A.
- c. SMACNA Leakage Class for Rectangular: 2.
- d. SMACNA Leakage Class for Round and Flat Oval: 2.

C. Return Ducts:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 1-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 2.
 - d. SMACNA Leakage Class for Round and Flat Oval: 2.
 2. Ducts Connected to Air-Handling Units Insert equipment:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 2.
 - d. SMACNA Leakage Class for Round and Flat Oval: 2.
 3. Ducts Connected to Equipment Not Listed above:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 2.
 - d. SMACNA Leakage Class for Round and Flat Oval: 2.
- D. Exhaust Ducts:
1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 2.
 - d. SMACNA Leakage Class for Round and Flat Oval: 2.
 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 2.
 - d. SMACNA Leakage Class for Round and Flat Oval: 2.
 3. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.
 - a. Exposed to View: Type 304, stainless-steel sheet, No. 4 finish.
 - b. Concealed: Type 304, stainless-steel sheet, No. 2D finish.
 - c. Welded seams and joints.
 - d. Pressure Class: Positive or negative 2-inch wg.
 - e. Airtight/watertight.
 4. Ducts Connected to Dishwashers, Dishwasher Hoods, and Other High-Humidity Locations:
 - a. Type 304, stainless-steel sheet.
 - b. Exposed to View: No. 4 finish.
 - c. Concealed: No. 2D finish.
 - d. Welded longitudinal seams; welded or flanged transverse joints with watertight EPDM gaskets.
 - e. Pressure Class: Positive or negative 2-inch wg.
 - f. Airtight/watertight.
 5. Ducts Connected to Fans Exhausting Fume Hood, Laboratory, and Process (ASHRAE 62.1, Class 3 and Class 4) Air:
 - a. Type 316, stainless-steel sheet.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- 1) Exposed to View: No. 4 finish.
 - 2) Concealed: No. 2B finish.
 - b. Pressure Class: Positive or negative 3-inch wg.
 - c. Welded seams and joints.
 - d. Airtight/watertight.
- E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 8.
 - d. SMACNA Leakage Class for Round and Flat Oval: 8.
 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 2.
 - d. SMACNA Leakage Class for Round and Flat Oval: 2.
 3. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 2.
 - d. SMACNA Leakage Class for Round and Flat Oval: 2.
- F. Intermediate Reinforcement:
1. Galvanized-Steel Ducts: Galvanized steel.
 2. PVC-Coated Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Match duct material.
 3. Stainless-Steel Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Match duct material.
 4. Aluminum Ducts: Aluminum.
- G. Liner:
1. Supply-Air Ducts: Fibrous glass, Type I, 1 inch(es thick).
 2. Return-Air Ducts: Fibrous glass, Type I, 1 inch(es thick).
 3. Exhaust-Air Ducts: Fibrous glass, Type I, inch(es thick).
 4. Supply Fan Plenums: Fibrous glass, Type II, 1 inch(es thick).
 5. Return- and Exhaust-Fan Plenums: Fibrous glass, Type II, 2 inches thick.
 6. Transfer Ducts: Fibrous glass, Type I, 1 inch(es thick).
- H. Double-Wall Duct Interstitial Insulation:
1. Supply-Air Ducts: 1-1/2 inches thick.
 2. Return-Air Ducts: 1-1/2 inches thick.
 3. Exhaust-Air Ducts: 1 inch thick.
- I. Elbow Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Velocity 1000 fpm or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.
 - b. Velocity 1000 to 1500 fpm:
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - c. Velocity 1500 fpm or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
 - 4) Radius-to Diameter Ratio: 1.5.
 - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 14 Inches and Larger in Diameter: Welded.
- J. Branch Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Conical spin in.
 2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity 1000 fpm or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm: Conical tap.
 - c. Velocity 1500 fpm or Higher: 45-degree lateral.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

END OF SECTION

SECTION 23 33 00 - DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Backdraft dampers.
 - 2. Manual volume control dampers.
 - 3. Fire and smoke dampers.
 - 4. Actuators.
 - 5. Duct silencers.
 - 6. Turning vanes.
 - 7. Duct-mounted access doors and panels.
 - 8. Flexible connectors.
 - 9. Flexible ducts.
 - 10. Accessories hardware.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 23 Section "Air Outlets and Inlets" for diffusers, registers, and grilles.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data including details for materials, dimensions of individual components, profiles, and finishes for the following items:
 - 1. Backdraft dampers.
 - 2. Manual volume control dampers.
 - 3. Fire and smoke dampers.
 - 4. Duct-mounted access panels and doors.
 - 5. Flexible ducts.
- C. Shop drawings from manufacturer detailing assemblies. Include dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection. Detail the following:
 - 1. Special fittings and volume control damper installation (both manual and automatic) details.
 - 2. Fire and smoke damper installations, including sleeves and duct-mounted access door and panel installations.
- D. Product Certification: Submit certified test data on dynamic insertion loss; self-noise power levels; and airflow performance data, static pressure loss, and dimensions and weights.

1.4 QUALITY ASSURANCE

- A. NFPA Compliance: Comply with the following NFPA Standards:
 - 1. NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
 - 2. NFPA 90B, "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 - PRODUCTS

2.1 MANUAL VOLUME CONTROL DAMPERS

- A. General: Provide factory-fabricated volume-control dampers, complete with required hardware and accessories. Stiffen damper blades to provide stability under operating conditions. Provide locking

device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class. Extend axles full length of damper blades. Provide bearings at both ends of operating shaft.

- B. Standard Volume Control Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside of air stream, and suitable for horizontal or vertical applications.
 - 1. Steel Frames: Hat-shaped, galvanized-steel channels, minimum of 16 gage, and with mitered and welded corners. Provide frames with flanges where indicated for attaching to walls. Provide flangeless frames where indicated for installation in ducts.
 - 2. Roll-Formed Steel Blades: 16-gage galvanized steel.
 - 3. Blade Axles: Galvanized steel.
 - 4. Tie Bars and Brackets: Galvanized steel.

2.2 FIRE DAMPERS

- A. General: UL labeled according to UL Standard 555 "Standard for Fire Dampers." Refer to Fire Damper Schedule at the end of this Section.
- B. Fire Rating: 1-1/2 or 3 hours, as indicated.
- C. Frame: Type B; fabricated with roll-formed, 21-gage, galvanized-steel; with mitered and interlocking corners.
- D. Mounting Sleeve: Factory-installed or field-installed galvanized steel.
 - 1. Minimum Thickness: 0.056-inch (16-gage) or 0.138-inch (10-gage) thick as indicated, and length to suit application.
 - 2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of the wall or floor, and thickness of damper frame meets sleeve requirements.
- E. Mounting Orientation: Vertical or horizontal as indicated.
- F. Blades: Roll-formed, interlocking, 21-gage galvanized steel. In place of interlocking blades, provide full-length, 21-gage, galvanized-steel blade connectors.
- G. Horizontal Dampers: Include a blade lock and stainless steel negator closure spring.
- H. Fusible Link: Replaceable, 165 deg F rated.

2.3 CEILING FIRE DAMPERS

- A. General: UL listed and labeled; comply with the construction details for the tested floor/roof-ceiling assemblies as indicated in the UL Fire Resistance Directory.
- B. Frame: 20-gage, rectangular or round, galvanized steel; style to suit ceiling construction.
- C. Blades: 22-gage galvanized steel with nonasbestos refractory insulation.
- D. Fusible Link: Replaceable, 165 deg F rated.

2.4 TURNING VANES

- A. Manufactured Turning Vanes: Fabricate of 1-1/2-inch-wide, curved blades set at 3/4 inch on center, support with bars perpendicular to blades set at 2 inches on center, and set into side strips suitable for mounting in ducts.

2.5 DUCT-MOUNTED ACCESS DOORS AND PANELS

- A. General: Refer to the Access Door Materials Schedule at the end of this Section for frame and door thickness, number of hinges and locks, and location of locks. Provide construction and airtightness suitable for duct pressure class.
- B. Frame: Galvanized sheet steel. Provide with bend-over tabs and foam gaskets.
- C. Door: Double-wall, galvanized sheet metal construction with insulation fill and thickness, number of hinges and locks as indicated for duct pressure class. Provide vision panel where indicated. Provide 1-inch by 1-inch butt hinge or piano hinge and cam latches.
- D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber seals.
- E. Insulation: 1-inch thick fiber glass or polystyrene foam board.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2.6 FLEXIBLE CONNECTORS

- A. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL Standard 181, Class 1.
- B. Standard Metal-Edged Connectors: Factory-fabricated with a strip of fabric 3-1/2 inches wide attached to 2 strips of 2-3/4-inch-wide, 24-gage, galvanized sheet steel or 0.032-gage aluminum sheets. Select metal compatible with connected duct system. Fold and crimp metal edge strips onto fabric as illustrated in SMACNA HVAC Duct Standard, 1st Edition, Figure 2-19.
- C. Conventional, Indoor System Flexible Connectors Fabric: Glass fabric double coated with polychloroprene.
 - 1. Minimum Weight: 26 oz. per sq yd.
 - 2. Tensile Strength: 480 lb per inch in the warp and 360 lb per inch in the filling.
- F. Conventional, Outdoor System Flexible Connectors Fabric: Glass fabric double coated with Du Pont's HYPALON or other synthetic-rubber weatherproof coating resistant to the sun's ultraviolet rays and ozone environment.
 - 1. Minimum Weight: 26 oz. per sq yd.
 - 2. Tensile Strength: 530 lb per inch in the warp and 440 lb per inch in the filling.

2.7 FLEXIBLE DUCTS

- A. General: Comply with UL 181, Class 1.
- B. Flexible Ducts - Insulated: Factory-fabricated, insulated, round duct, with an outer jacket enclosing 1-1/2-inch-thick, glass fiber insulation around a continuous inner liner.
 - 1. Reinforcement: Steel-wire helix encapsulated in the inner liner.
 - 2. Outer Jacket: Polyethylene film.
 - 3. Inner Liner: Polyethylene film.

2.8 ACCESSORIES HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket and a flat mounting gasket. Size to allow insertion of pitot tube and other testing instruments and provide in length to suit duct insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of duct accessories. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. Install duct accessories according to manufacturer's installation instructions and applicable portions of details of construction as shown in SMACNA standards.
- B. Install volume control dampers in lined duct with methods to avoid damage to liner and to avoid erosion of duct liner.
- C. Provide test holes at fan inlet and outlet and elsewhere as indicated.
- D. Install fire and smoke dampers according to the manufacturer's UL-approved printed instructions.
- E. Install fusible links in fire dampers.
- F. Label access doors according to Division 23.

3.3 ADJUSTING

- A. Adjust duct accessories for proper settings.
- B. Adjust fire and smoke dampers for proper action.
- C. Final positioning of manual dampers is specified in Division 23 Section "Testing, Adjusting, and

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
 MENTAL HEALTH / MEDICAL UNIT
 ANNISTON, ALABAMA

Balancing."

ACCESS DOOR MATERIALS SCHEDULE

<u>DUCT</u>	<u>DOOR</u>	<u>NUMBER</u>	<u>NUMBER</u>	<u>METAL GAGE</u>		
<u>PRESSURE</u>	<u>SIZE</u>	<u>OF</u>	<u>LOCKS</u>	<u>FRAME</u>	<u>DOOR</u>	<u>BACK</u>
<u>CLASS</u>	<u>INCHES</u>	<u>HINGES</u>				
2 INCHES	12X12	2	1-S	24	26	26
& LESS	16x20	2	2-S	22	24	26
	24X24	3	2-S	22	22	26

S: SIDE
 T: TOP
 B: BOTTOM

END OF SECTION

SECTION 23 37 13 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. Extent of air outlets and inlets work is indicated by drawings and schedules, and by requirements of this section.
- B. Types of outlets and inlets required for project include the following:
 - 1. Ceiling air diffusers.
 - 2. Wall registers and grilles.
 - 3. Louvers.
- C. Refer to other Division-23 sections for ductwork and duct accessories required in conjunction with air outlets and inlets; not work of this section.
- D. Refer to other Division-23 sections for balancing of air outlets and inlets; not work of this section.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
 - 1. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".
 - 2. AMCA Compliance: Test and rate louvers in accordance with AMCA 500 "Test Method for Louvers, Dampers and Shutters".
 - 3. AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.
 - 4. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:
 - 1. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.
 - 2. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.
 - 3. Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses; throw and drop; and noise criteria ratings. Indicate selections on data.
- B. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.
- C. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 1.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver air outlets and inlets wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.
- B. Store air outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose

with waterproof wrapping.

PART 2 - PRODUCTS

2.1 CEILING AIR DIFFUSERS

- A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.
- C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.
- D. Types: Provide ceiling diffusers of type, capacity, and with accessories and finishes as listed on diffuser schedule. The following requirements shall apply to nomenclature indicated on schedule.
 1. Diffuser Faces:
 - a. Round (RD): Round housing, core of concentric rings, round duct connection.
 - b. Square: Square housing, core of square concentric louvers, square or round duct connection.
 - c. Rectangular: Rectangular housing, core of rectangular concentric louvers, square or round duct connection.
 - d. Panel: Square or rectangular housing extended to form a panel to fit in ceiling system module, core of square or rectangular concentric louvers, square or round duct connection.
 - e. Perforated: Round, square, or rectangular housing covered with removable perforated panel in frame. Conceal air pattern devices above panel.
 - f. Linear: Extruded aluminum continuous slot, single or multiple.
 2. Diffuser Mountings:
 - a. Stepped-Down: Diffuser housing below ceiling with perimeter flange and gasket to seal against ceiling construction.
 - b. Flush: Diffuser housing above ceiling surface with flush perimeter flange and gasket to seal against ceiling.
 - c. Lay-In: Diffuser housing sized to fit between ceiling exposed suspension tee bars and rest on top surface of tee bar.
 3. Diffuser Patterns:
 - a. Fixed (FX): Fixed position core with concentric rings or louvers for radial air flow around entire perimeter of diffuser.
 - b. 2 Position (2-P): Manual 2-position core with concentric rings or louvers, upper position for horizontal air flow, lower position for vertical air flow.
 - c. Adjustable (ADJ): Manual adjustable core with concentric rings or louvers, fully adjustable for horizontal to vertical air flow.
 - d. 1 Way (1-W): Fixed louver face for 1-direction air flow, direction indicated on drawings.
 - e. 2 Way (2-W): Fixed louver face for 2-direction air flow, directions indicated on drawings.
 - f. 3 Way (3-W): Fixed louver face for 3-direction air flow, directions indicated on drawings.
 - g. 4 Way (4-W): Fixed louver face for 4-direction air flow, directions indicated on drawings.
 4. Diffuser Dampers:
 - a. Opposed Blade (O-B): Adjustable opposed blade damper assembly, key operated from face of diffuser.
 - b. Butterfly (BTFY): Two semicircular flaps connected to linkage adjustable from face of

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

diffuser with key, and with straightening grid.

- c. Supply and Return (S & R): For supply and return diffusers, butterfly type damper in return neck, annular adjustable dampers in supply duct.
 - d. Fire Damper (F-D): Combination adjustable opposed blade damper and fusible link fire damper with UL approved link and assembly designed to meet requirements of NFPA 90A.
5. Diffuser Accessories:
- a. Equalizing Deflectors (E-D): Adjustable parallel blades in frame for straightening air flow.
 - b. Smudge Ring (S-R): Extension perimeter frame around diffuser, sized so induced air impinges on frame and not on ceiling.
 - c. Plaster Ring (P-R): Perimeter ring designed to act as a plaster stop and diffuser anchor.
 - d. Extractor (EXTR): Curved blades mounted on adjustable frame to produce air scooping action in duct at diffuser take-off.
6. Diffuser Finishes:
- a. White Enamel (W-E): Semi-gloss white enamel prime finish.
- E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering diffusers which may be incorporated in the work include, but are not limited to, the following:
- 1. Anemostat Products Div.; Dymanics Corp. of America.
 - 2. Cranes Co.; Div. of Wehr Corp.
 - 3. Krueger Mfg. Co.
 - 4. Titus Products Div.; Philips Industries, Inc.
 - 5. Tuttle & Bailey; Div. of Interpace Corp.

2.2 WALL REGISTERS AND GRILLES

- A. General: Except as otherwise indicated, provide manufacturer's standard wall registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Performance: Provide wall registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device and listed in manufacturer's current data.
- C. Wall Compatibility: Provide registers and grilles with border styles that are compatible with adjacent wall systems, and that are specifically manufactured to fit into wall construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of wall construction which will contain each type of wall register and grille.
- D. Types: Provide wall registers and grilles of type, capacity, and with accessories and finishes as listed on register and grille schedule.
- E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering registers and grilles which may be incorporated in the work include, but are not limited to, the following:
 - 1. Anemostat Products Div.; Dynamics Corp. of America.
 - 2. Carnes Co.; Div. of Wehr Corp.
 - 3. Titus Products Div.; Philips Industries, Inc.

2.3 LOUVERS

- A. General: Except as otherwise indicated, provide manufacturer's standard louvers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Performance: Provide louvers that have minimum free area, and maximum pressure drop of each type as listed in manufacturer's current data, complying with louver schedule.
- C. Substrate Compatibility: Provide louvers with frame and sill styles that are compatible with adjacent substrate, and that are specifically manufactured to fit into construction openings with accurate fit and adequate support, for weatherproof installation. Refer to general construction drawings and specifications for types of substrate which will contain each type of louver.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- D. Materials: Construct of aluminum extrusions, ASTM B 221, Alloy 6063-T52. Weld units or use stainless steel fasteners.
- E. Louver Screens: On inside face of exterior louvers, provide 1/2" square mesh anodized aluminum wire bird screens mounted in removable extruded aluminum frames.
- F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering louvers which may be incorporated in the work include, but are not limited to, the following:
 - 1. Airline Products Co.
 - 2. Airolite Co.
 - 3. American Warming & Ventilating Inc.
 - 4. Arrow United Industries, Inc.
 - 5. Construction Specialties, Inc.
 - 6. Dowco Corp.
 - 7. Industrial Louvers, Inc.
 - 8. Louvers & Dampers, Inc.
 - 9. Penn Ventilator Co., Inc.
 - 10. Ruskin Mfg. Co.
 - 11. Safe-Air Inc.
 - 12. Snyder (E.G.) Co., Inc.
 - 13. Vent Products Co., Inc.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended function.
- B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.
- C. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling module.

3.3 SPARE PARTS

- A. Furnish to Owner, with receipt, 3 operating keys for each type of air outlet and inlet that require them.

END OF SECTION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 26: ELECTRICAL
Section 26 05 18 - Basic Electrical Materials and Methods

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 1. Supporting devices for electrical components.
 2. Electrical identification.
 3. Electricity-metering components.
 4. Concrete equipment bases.
 5. Electrical demolition.
 6. Cutting and patching for electrical construction.
 7. Touchup painting.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.4 COORDINATION

- A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
 1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
- B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- C. Coordinate electrical service connections to components furnished by utility companies.
 1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
 2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- D. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Division 8 Section "Access Doors."
- E. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.
- F. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

- A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.
- B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
- C. Slotted-Steel Channel Supports: Flange edges turned toward web, and **9/16-inch- (14-mm-)** diameter slotted holes at a maximum of **2 inches (50 mm)** o.c., in webs.
 - 1. Channel Thickness: Selected to suit structural loading.
 - 2. Fittings and Accessories: Products of the same manufacturer as channel supports.
- D. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.
- E. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
- F. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.
- G. Expansion Anchors: Carbon-steel wedge or sleeve type.
- H. Toggle Bolts: All-steel springhead type.
- I. Powder-Driven Threaded Studs: Heat-treated steel.

2.2 ELECTRICAL IDENTIFICATION

- A. Identification Devices: A single type of identification product for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.
- B. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:
 - 1. Not less than **6 inches wide by 4 mils thick (150 mm wide by 0.102 mm thick)**.
 - 2. Compounded for permanent direct-burial service.
 - 3. Embedded continuous metallic strip or core.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

4. Printed legend that indicates type of underground line.
- C. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
 - D. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.
 - E. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners **1/16-inch (1.6-mm)** minimum thickness for signs up to **20 sq. in. (129 sq. cm)** and **1/8-inch (3.2-mm)** minimum thickness for larger sizes. Engraved legend in black letters on white background.
 - F. Interior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Pre-printed, aluminum, baked-enamel-finish signs, punched or drilled for mechanical fasteners, with colors, legend, and size appropriate to the application.
 - G. Exterior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with **0.0396-inch (1-mm)**, galvanized-steel backing, with colors, legend, and size appropriate to the application. **1/4-inch (6-mm)** grommets in corners for mounting.
 - H. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.
- 2.3 EQUIPMENT FOR UTILITY COMPANY'S ELECTRICITY METERING
- A. Meter Sockets: Comply with requirements of electrical power utility company.
- 2.4 CONCRETE BASES
- A. Concrete Forms and Reinforcement Materials: As specified in Division 3 Section "Cast-in-Place Concrete."
 - B. Concrete: **3000-psi (20.7-MPa)**, 28-day compressive strength as specified in Division 3 Section "Cast-in-Place Concrete."
- 2.5 TOUCHUP PAINT
- A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
 - B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

- A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 WIRING INSTALLATION

- A. Install splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- B. Install wiring at outlets with at least **12 inches (300 mm)** of slack conductor at each outlet.
- C. Connect outlet and component connections to wiring systems and to ground. Tighten electrical connectors and terminals, according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3.3 ELECTRICAL SUPPORTING DEVICE APPLICATION

- A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.
- B. Dry Locations: Steel materials.
- C. Support Clamps for PVC Raceways: Click-type clamp system.
- D. Selection of Supports: Comply with manufacturer's written instructions.
- E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of **200-lb (90-kg)** design load.

3.4 SUPPORT INSTALLATION

- A. Install support devices to securely and permanently fasten and support electrical components.
- B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
- D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
- E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- F. Install **1/4-inch- (6-mm-)** diameter or larger threaded steel hanger rods, unless otherwise indicated.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 3/4-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.
- H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- I. Simultaneously install vertical conductor supports with conductors.
- J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches (610 mm) from the box.
- K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
- L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
- M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
 - 1. Wood: Fasten with wood screws or screw-type nails.
 - 2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
 - 3. New Concrete: Concrete inserts with machine screws and bolts.
 - 4. Existing Concrete: Expansion bolts.
 - 5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
 - 6. Steel: Welded threaded studs or spring-tension clamps on steel.
 - a. Field Welding: Comply with AWS D1.1.
 - 7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
 - 8. Light Steel: Sheet-metal screws.
 - 9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.5 IDENTIFICATION MATERIALS AND DEVICES

- A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.
- C. Self-Adhesive Identification Products: Clean surfaces before applying.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- D. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.
- E. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate **6 to 8 inches (150 to 200 mm)** below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed **16 inches (400 mm)**, overall, use a single line marker.
- F. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

3.6 UTILITY COMPANY ELECTRICITY-METERING EQUIPMENT

- A. Install equipment according to utility company's written requirements. Provide grounding and empty conduits as required by utility company.

3.7 FIRESTOPPING

- A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. The firestopping shall be made in accordance with a UL listed assembly.

3.8 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than **4 inches (100 mm)** larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use **3000-psi (20.7-MPa)**, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.9 DEMOLITION

- A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.
- B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.
- C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, **2 inches (50 mm)** below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.
- D. Remove demolished material from Project site.
- E. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3.10 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.11 FIELD QUALITY CONTROL

- A. Inspect installed components for damage and faulty work, including the following:
 - 1. Supporting devices for electrical components.
 - 2. Electrical identification.
 - 3. Electricity-metering components.
 - 4. Concrete bases.
 - 5. Electrical demolition.
 - 6. Cutting and patching for electrical construction.
 - 7. Touchup painting.

3.12 REFINISHING AND TOUCHUP PAINTING

- A. Refinish and touch up paint.
 - 1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
 - 2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
 - 3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.13 CLEANING AND PROTECTION

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION 26 05 18

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 26: ELECTRICAL
Section 26 05 19 - Conductors and Cables

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.3 SUBMITTALS

- A. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.4 QUALITY ASSURANCE

- A. Listing and Labeling: Provide wires and cables specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.
- B. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wires and cables according to NEMA WC 26.

1.6 COORDINATION

- A. Coordinate layout and installation of cables with other installations.
- B. Revise locations and elevations from those indicated, as required to suit field conditions and as approved by Architect.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Wires and Cables:
 - a. American Insulated Wire Corp.; Leviton Manufacturing Co.
 - b. BICC Brand-Rex Company.
 - c. Senator Wire & Cable Company.
 - d. Southwire Company.
 - 2. Connectors for Wires and Cables:
 - a. AMP Incorporated.
 - b. General Signal; O-Z/Gedney Unit.
 - c. Monogram Co.; AFC.
 - d. Square D Co.; Anderson.
 - e. 3M Company; Electrical Products Division.

2.2 BUILDING WIRES AND CABLES

- A. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified in Part 3 "Wire and Insulation Applications" Article.
- B. Rubber Insulation Material: Comply with NEMA WC 3.
- C. Thermoplastic Insulation Material: Comply with NEMA WC 5.
- D. Cross-Linked Polyethylene Insulation Material: Comply with NEMA WC 7.
- E. Ethylene Propylene Rubber Insulation Material: Comply with NEMA WC 8.
- F. Conductor Material: Copper.
- G. Stranding: Solid conductor for No. 10 AWG and smaller; stranded conductor for larger than No. 10 AWG.

2.3 CONNECTORS AND SPLICES

- A. UL-listed, factory-fabricated wiring connectors of size, ampacity rating, material, type, and class for application and service indicated. Comply with Project's installation requirements and as specified in Part 3 "Wire and Insulation Applications" Article.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine raceways and building finishes to receive wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3.2 WIRE AND INSULATION APPLICATIONS

- A. Service Entrance: Type RHW or THWN, in raceway.
- B. Feeders: Type THHN/THWN, in raceway.
- C. Branch Circuits: Type THHN/THWN, in raceway.
- D. Fire Alarm Circuits: Type THHN/THWN, in raceway.
- E. Class 1 Control Circuits: Type THHN/THWN, in raceway.
- F. Class 2 Control Circuits: Type THHN/THWN, in raceway.

3.3 INSTALLATION

- A. Install wires and cables as indicated, according to manufacturer's written instructions and NECA's "Standard of Installation."
- B. Remove existing wires from raceway before pulling in new wires and cables.
- C. Pull Conductors: Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables, parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Division 26 Section "Basic Electrical Materials and Methods."
- G. Seal around cables penetrating fire-rated elements according to Division 7 Section "Firestopping."
- H. Identify wires and cables according to Division 26 Section "Basic Electrical Materials and Methods."

3.4 CONNECTIONS

- A. Conductor Splices: Keep to minimum.
- B. Install splices and tapes that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.
- C. Use splice and tap connectors compatible with conductor material.
- D. Wiring at Outlets: Install conductor at each outlet, with at least **12 inches (300 mm)** of slack.
- E. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

- A. Testing: On installation of wires and cables and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.
- B. Correct malfunctioning conductors and cables at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

END OF SECTION 26 05 19

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 26: ELECTRICAL
Section 26 05 26 - Grounding and Bonding

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 1. Comply with UL 467.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Grounding Conductors, Cables, Connectors, and Rods:
 - a. Apache Grounding/Erico Inc.
 - b. Chance/Hubbell.
 - c. Copperweld Corp.
 - d. Dossert Corp.
 - e. Erico Inc.; Electrical Products Group.
 - f. Framatome Connectors/Burndy Electrical.
 - g. Galvan Industries, Inc.
 - h. Ideal Industries, Inc.
 - i. ILSCO.
 - j. Kearney/Cooper Power Systems.
 - k. Lyncole XIT Grounding.
 - l. O-Z/Gedney Co.; a business of the EGS Electrical Group.
 - m. Raco, Inc.; Division of Hubbell.
 - n. Thomas & Betts, Electrical.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2.2 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 26 Section "Conductors and Cables."
- B. Equipment Grounding Conductors: Insulated with green-colored insulation.
- C. Grounding Electrode Conductors: Stranded cable.
- D. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- E. Bare Copper Conductors: Comply with the following:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Assembly of Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
- F. Copper Bonding Conductors: As follows:
 - 1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch (6.4 mm) in diameter.
 - 2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
 - 3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.
 - 4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.
- G. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

2.3 CONNECTOR PRODUCTS

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

2.4 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel.
 - 1. Size: 3/4 by 120 inches.

PART 3 - EXECUTION

3.1 APPLICATION

- A. In raceways, use insulated equipment grounding conductors.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections.
- C. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

3.2 EQUIPMENT GROUNDING CONDUCTORS

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Install equipment grounding conductors in all feeders and circuits.
- C. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.
- D. Air-Duct Equipment Circuits: Install an equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.
- E. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.
- F. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 - 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a grounding bus.
 - 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- G. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.

3.3 INSTALLATION

- A. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.
 - 1. Drive ground rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
 - 2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.
- B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

- D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- E. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.
- F. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.
- G. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.

3.4 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
- E. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.
- F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- G. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.5 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
 - 1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
 - a. Equipment Rated 500 kVA and Less: 10 ohms.
 - b. Equipment Rated 500 to 1000 kVA: 5 ohms.
 - c. Equipment Rated More Than 1000 kVA: 3 ohms.
 - 2. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 26: ELECTRICAL
Section 26 05 33 – Raceways and Boxes

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

- 1. Raceways include the following:

- a. RMC.
 - b. IMC.
 - c. EMT.
 - d. FMC.
 - e. LFMC.
 - f. LFNC.
 - g. RNC.

- 2. Boxes, enclosures, and cabinets include the following:

- a. Device boxes.
 - b. Outlet boxes.
 - c. Pull and junction boxes.

- B. Related Sections include the following:

- 1. Division 7 Section "Firestopping."
 - 2. Division 26 Section "Basic Electrical Materials and Methods" for raceways and box supports.
 - 3. Division 26 Section "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. FMC: Flexible metal conduit.
- D. IMC: Intermediate metal conduit.
- E. LFMC: Liquidtight flexible metal conduit.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- F. LFNC: Liquidtight flexible nonmetallic conduit.
- G. RMC: Rigid metal conduit.
- H. RNC: Rigid nonmetallic conduit.

1.4 QUALITY ASSURANCE

- A. Listing and Labeling: Provide raceways and boxes specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.
- B. Comply with NECA's "Standard of Installation."
- C. Comply with NFPA 70.

1.5 COORDINATION

- A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Metal Conduit and Tubing:
 - a. Alflex Corp.
 - b. Anamet, Inc.; Anaconda Metal Hose.
 - c. Anixter Brothers, Inc.
 - d. Grinnell Co.; Allied Tube and Conduit Div.
 - e. Monogram Co.; AFC.
 - f. Wheatland Tube Co.
 - 2. Nonmetallic Conduit and Tubing:
 - a. Anamet, Inc.; Anaconda Metal Hose.
 - b. Hubbell, Inc.; Raco, Inc.
 - c. Lamson & Sessions; Carlon Electrical Products.
 - d. R&G Sloan Manufacturing Co., Inc.
 - e. Thomas & Betts Corp.
 - 3. Conduit Bodies and Fittings:
 - a. American Electric; Construction Materials Group.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- b. Crouse-Hinds; Div. of Cooper Industries.
- c. Emerson Electric Co.; Appleton Electric Co.
- d. Hubbell, Inc.; Killark Electric Manufacturing Co.
- e. Lamson & Sessions; Carlon Electrical Products.
- f. O-Z/Gedney; Unit of General Signal.
- g. Scott Fetzer Co.; Adalet-PLM.
- h. Spring City Electrical Manufacturing Co.

4. Boxes, Enclosures, and Cabinets:

- a. Crouse-Hinds; Div. of Cooper Industries.
- b. Electric Panelboard Co., Inc.
- c. Erickson Electrical Equipment Co.
- d. Hoffman Engineering Co.; Federal-Hoffman, Inc.
- e. Hubbell Inc.; Killark Electric Manufacturing Co.
- f. Hubbell Inc.; Raco, Inc.
- g. Lamson & Sessions; Carlon Electrical Products.
- h. O-Z/Gedney; Unit of General Signal.
- i. Thomas & Betts Corp.
- j. Woodhead Industries, Inc.; Daniel Woodhead Co.

2.2 METAL CONDUIT AND TUBING

- A. Rigid Steel Conduit: ANSI C80.1.
- B. IMC: ANSI C80.6.
- C. Plastic-Coated Steel Conduit and Fittings: NEMA RN 1.
- D. Plastic-Coated IMC and Fittings: NEMA RN 1.
- E. EMT and Fittings: ANSI C80.3.
 - 1. Fittings: Compression type.
- F. FMC: Zinc-coated steel.
- G. LFMC: Flexible steel conduit with PVC jacket.
- H. Fittings: NEMA FB 1; compatible with conduit/tubing materials.

2.3 NONMETALLIC CONDUIT AND TUBING

- A. RNC: NEMA TC 2, Schedule 40 or 80 PVC.
- B. RNC Fittings: NEMA TC 3; match to conduit or conduit/tubing type and material.
- C. LFNC: UL 1660.

2.4 OUTLET AND DEVICE BOXES

- A. Sheet Metal Boxes: NEMA OS 1.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. Cast-Metal Boxes: NEMA FB 1, Type FD, cast box with gasketed cover.
- C. Nonmetallic Boxes: NEMA OS 2.

2.5 PULL AND JUNCTION BOXES

- A. Small Sheet Metal Boxes: NEMA OS 1.
- B. Cast-Metal Boxes: NEMA FB 1, cast aluminum with gasketed cover.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRING METHODS

- A. Outdoors: Use the following wiring methods:
 - 1. Exposed: Rigid steel or IMC.
 - 2. Concealed: Rigid steel or IMC.
 - 3. Underground, Single Run: RNC.
 - 4. Underground, Grouped: RNC.
 - 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 6. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.
- B. Indoors: Use the following wiring methods:
 - 1. Exposed: Rigid steel or IMC.
 - 2. Concealed: EMT.
 - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except in wet or damp locations, use LFMC.
 - 4. Damp or Wet Locations: Rigid steel conduit.
 - 5. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
 - a. Damp or Wet Locations: NEMA 250, Type 3R.

3.3 INSTALLATION

- A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.
- B. Minimum Raceway Size: 1/2-inch trade size (DN16).

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- C. Conceal conduit and EMT, unless otherwise indicated, within finished walls, ceilings, and floors. Note that conduit will only be allowed to be exposed in electrical and mechanical rooms and chases. All conduit shall be concealed in finished spaces. All conduit for the first floor shall be either ran under the slab or routed through the attic and down the chases. All door control conduits shall be routed through the attic and down through the chases, not in the slab. Note that there are two chases in Control 127 for routing of conduits. Note that no conduits shall be routed exposed through Storage 246 under base bid as this area will be fitted out at a later date if the alternate is not taken.
- D. Keep raceways at least **6 inches (150 mm)** away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- E. Install raceways level and square and at proper elevations. Provide adequate headroom.
- F. Complete raceway installation before starting conductor installation.
- G. Support raceways as specified in Division 26 Section "Basic Electrical Materials and Methods."
- H. Use temporary closures to prevent foreign matter from entering raceways.
- I. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.
- J. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.
- K. Use raceway fittings compatible with raceways and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, unless otherwise indicated.
- L. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.
- M. Raceways Embedded in Slabs: Install in middle third of slab thickness where practical, and leave at least **1-inch (25-mm)** concrete cover.
 - 1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
 - 2. Space raceways laterally to prevent voids in concrete.
 - 3. Run conduit larger than **1-inch trade size (DN27)** parallel to or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 - 4. Transition from nonmetallic tubing to rigid steel conduit before rising above floor.
- N. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.
 - 1. Run parallel or banked raceways together, on common supports where practical.
 - 2. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- O. Join raceways with fittings designed and approved for the purpose and make joints tight.
 - 1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
 - 2. Use insulating bushings to protect conductors.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- P. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside the box.
- Q. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.
- R. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of the pull wire.
- S. Flexible Connections: Use maximum of 6 feet (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.
- T. Do not install aluminum conduits embedded in or in contact with concrete.
- U. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.4 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.5 CLEANING

- A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION 26 05 33

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 26: ELECTRICAL
Section 26 2200 - Dry-Type Transformers (1000 V and Less)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes dry-type distribution and specialty transformers rated 1000 V and less.

1.3 SUBMITTALS

- A. Product Data: Include data on features, components, ratings, and performance for each type of transformer specified. Include dimensioned plans, sections, and elevation views. Show minimum clearances and installed devices and features.
- B. Wiring Diagrams: Detail wiring and identify terminals for tap changing and connecting field-installed wiring.
- C. Product Certificates: Signed by manufacturers of transformers certifying that the products furnished comply with requirements.
- D. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- E. Field Test Reports: Indicate and interpret test results for tests specified in Part 3.
- F. Maintenance Data: For transformers to include in the maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

- A. Listing and Labeling: Provide transformers specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.
- B. Comply with IEEE C2.
- C. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit throughout periods during which equipment is not energized and is not in a space that is continuously under normal control of temperature and humidity.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide transformers by one the following:
 - 1. GE Electrical Distribution & Control.
 - 2. Square D; Groupe Schneider.
 - 3. Eaton

2.2 TRANSFORMERS, GENERAL

- A. Description: Factory-assembled and -tested, air-cooled units of types specified, designed for 60-Hz service.
- B. Cores: Grain-oriented, nonaging silicon steel.
- C. Coils: Continuous windings without splices, except for taps.
- D. Internal Coil Connections: Brazed or pressure type.
- E. Enclosure: Class complies with NEMA 250 for the environment in which installed.

2.3 GENERAL-PURPOSE DISTRIBUTION AND POWER TRANSFORMERS

- A. Comply with NEMA ST 20 and list and label as complying with UL 1561.
- B. Cores: One leg per phase.
- C. Windings: One coil per phase in primary and secondary.
- D. Enclosure: Indoor, ventilated.
- E. Insulation Class: 185 or 220 deg C class for transformers 15 kVA or smaller; 220 deg C class for transformers larger than 15 kVA.
 - 1. Rated Temperature Rise: 150 deg C maximum rise above 40 deg C, for 220 deg C class insulation; 115 deg C maximum rise for 185 deg C class insulation.
- F. Taps: For transformers 3 kVA and larger, full-capacity taps in high-voltage windings are as follows:
 - 1. Taps, 15 through 500 kVA: Six 2.5-percent taps, 2 above and 4 below rated high voltage.

2.4 CONTROL AND SIGNAL TRANSFORMERS

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Units comply with NEMA ST 1 and are listed and labeled as complying with UL 506.
- B. Ratings: Continuous duty. If rating is not indicated, provide capacity exceeding peak load by 50 percent minimum.
- C. Description: Self-cooled, 2 windings.

2.5 FINISHES

- A. Indoor Units: Manufacturer's standard paint over corrosion-resistant pretreatment and primer.
- B. Outdoor Units: Comply with ANSI C57.12.28.

2.6 SOURCE QUALITY CONTROL

- A. Factory Tests: Design and routine tests comply with referenced standards.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with safety requirements of IEEE C2.
- B. Arrange equipment to provide adequate spacing for access and for circulation of cooling air.
- C. Identify transformers and install warning signs according to Division 16 Section "Basic Electrical Materials and Methods."
- D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.2 GROUNDING

- A. Separately Derived Systems: Comply with NFPA 70 requirements for connecting to grounding electrodes and for bonding to metallic piping near the transformer.
- B. Comply with Division 26 Section "Grounding" for materials and installation requirements.

3.3 FIELD QUALITY CONTROL

- A. Test Objectives: To ensure transformer is operational within industry and manufacturer's tolerances, is installed according to the Contract Documents, and is suitable for energizing.
- B. Test Labeling: On satisfactory completion of tests for each transformer, attach a dated and signed "Satisfactory Test" label to tested component.
- C. Schedule tests and provide notification at least 7 days in advance of test commencement.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- D. Report: Submit a written report of observations and tests. Report defective materials and installation.
- E. Tests: Include the following minimum inspections and tests according to manufacturer's written instructions. Comply with IEEE C57.12.91 for test methods and data correction factors.
 - 1. Inspect accessible components for cleanliness, mechanical and electrical integrity, and damage or deterioration. Verify that temporary shipping bracing has been removed. Include internal inspection through access panels and covers.
 - 2. Inspect bolted electrical connections for tightness according to manufacturer's published torque values or, if not available, those specified in UL 486A and UL 486B.
 - 3. Insulation Resistance: Perform megohmmeter tests of primary and secondary winding to winding and winding to ground.
 - a. Minimum Test Voltage: 1000 V, dc.
 - b. Minimum Insulation Resistance: 500 megohms.
 - c. Duration of Each Test: 10 minutes.
 - d. Temperature Correction: Correct results for test temperature deviation from 20 deg C standard.
- F. Test Failures: Compare test results with specified performance or manufacturer's data. Correct deficiencies identified by tests and retest. Verify that transformers meet specified requirements.

3.4 CLEANING

- A. On completion of installation, inspect components. Remove paint splatters and other spots, dirt, and debris. Repair scratches and mars on finish to match original finish. Clean components internally using methods and materials recommended by manufacturer.

3.5 ADJUSTING

- A. After installing and cleaning, touch up scratches and mars on finish to match original finish.
- B. Adjust transformer taps to provide optimum voltage conditions at utilization equipment throughout normal operating cycle of facility. Record primary and secondary voltages and tap settings and submit with test results.

END OF SECTION 26 22 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 26: ELECTRICAL
Section 26 24 16 - Panelboards

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes panelboards, overcurrent protective devices, and associated auxiliary equipment rated 600 V and less for the following types:
 - 1. Lighting and appliance branch-circuit panelboards.
 - 2. Distribution panelboards.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. RFI: Radio-frequency interference.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.
- F. TVSS: Transient voltage surge suppressor.

1.4 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, TVSS device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details for types other than NEMA 250, Type 1.
 - b. Bus configuration, current, and voltage ratings.
 - c. Short-circuit current rating of panelboards and overcurrent protective devices.
 - d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NEMA PB 1.
- C. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
 - a. General Electric Co.; Electrical Distribution & Control Div.
 - b. Eaton
 - c. Square D Co.

2.2 FABRICATION AND FEATURES

- A. Enclosures: Flush or surface mounted cabinets as indicated on drawings. NEMA PB 1, Type 1, to meet environmental conditions at installed location.
 - 1. Outdoor Locations: NEMA 250, Type 3R.
- B. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
- C. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
- D. Directory Card: With transparent protective cover, mounted inside metal frame, inside panelboard door.
- E. Bus: Hard-drawn copper, 98 percent conductivity.
- F. Main and Neutral Lugs: Mechanical type suitable for use with conductor material.
- G. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- H. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.
- I. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.
- J. Isolated Equipment Ground Bus: When noted on drawings, install isolated equipment ground bus adequate for branch-circuit equipment ground conductors; insulated from box.
- K. Feed-through Lugs: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device. Provide only when necessary or when noted on the drawings.

2.3 PANELBOARD SHORT-CIRCUIT RATING

- A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- B. Doors: Front mounted with concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.5 DISTRIBUTION PANELBOARDS

- A. Doors: Front mounted, except omit in fused-switch panelboards; secured with vault-type latch with tumbler lock; keyed alike.
- B. Main Overcurrent Protective Devices: Circuit breaker.
- C. Branch overcurrent protective devices shall be one of the following:
 - 1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
 - 2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
 - 3. Fused switches.

2.6 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 3. Electronic Trip Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.
 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
 6. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.
- B. Molded-Case Circuit-Breaker Features and Accessories. Standard frame sizes, trip ratings, and number of poles.
1. Lugs: Mechanical style, suitable for number, size, trip ratings, and material of conductors.
 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
 3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 4. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Mounting Heights: Top of trim **74 inches (1880 mm)** above finished floor, unless otherwise indicated.
- C. Mounting: Plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- D. Circuit Directory: Create a directory to indicate installed circuit loads. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- E. Install filler plates in unused spaces.
- F. Wiring in Panelboard Gutters: Arrange conductors into groups and bundle and wrap with wire ties.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Basic Electrical Materials and Methods".
- B. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.3 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

- A. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

3.6 CLEANING

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 26 24 16

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 26: ELECTRICAL
Section 26 27 26 – Wiring Devices

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes receptacles, connectors, switches, and finish plates.

1.3 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. TVSS: Transient voltage surge suppressor.

1.4 SUBMITTALS

- A. Product Data: For each product specified.
- B. Maintenance Data: For materials and products to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- B. Comply with NEMA WD 1.
- C. Comply with NFPA 70.

1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

WIRING DEVICES

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Wiring Devices:
 - a. Bryant Electric, Inc.
 - b. Eagle Electric Manufacturing Co., Inc.
 - c. Hubbell, Inc.; Wiring Devices Div.
 - d. Leviton Manufacturing Co., Inc.
 - e. Pass & Seymour/Legrand; Wiring Devices Div.
 - 2. Wiring Devices for Hazardous (Classified) Locations:
 - a. Crouse-Hinds Electrical Co.; Distribution Equipment Div.
 - b. Killark Electric Manufacturing Co.
 - 3. Multioutlet Assemblies:
 - a. Wiremold.
 - 4. Poke-through, Floor Service Outlets and Telephone/Power Poles:
 - a. Hubbell, Inc.; Wiring Devices Div.
 - b. Wiremold.

2.2 RECEPTACLES

- A. Straight-Blade and Locking Receptacles: Heavy-Duty grade, 20A.
- B. GFCI Receptacles: Termination type, with integral NEMA WD 6, Configuration 5-20R duplex receptacle. Design units for installation in a 2-3/4-inch- (70-mm-) deep outlet box without an adapter.
- C. Hazardous (Classified) Location Receptacles: Comply with NEMA FB 11.

2.3 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
 - 1. Cord: Rubber-insulated, stranded-copper conductors, with type SOW-A jacket. Green-insulated grounding conductor, and equipment-rating ampacity plus a minimum of 30 percent.
 - 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.4 SWITCHES

- A. Snap Switches: Heavy-duty, quiet type.
- B. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible and electromagnetic noise filters.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Control: Continuously adjustable slide. Single-pole or three-way switch to suit connections.
2. Incandescent Lamp Dimmers: Modular, 120 V, 60 Hz with continuously adjustable slide; single pole with soft tap or other quiet switch; electromagnetic filter to eliminate noise, RF, and TV interference; and 5-inch (130-mm) wire connecting leads.
3. Fluorescent Lamp Dimmers: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming to a maximum of 1 percent of full brightness.

2.5 WALL PLATES

- A. Single and combination types match corresponding wiring devices.
 1. Plate-Securing Screws: Metal with head color to match plate finish.
 2. Material for Finished Spaces: 0.04-inch- (1-mm-) thick, Type 302, satin-finished stainless steel.
 3. Material for Unfinished Spaces: Galvanized steel.

2.6 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartmentation: Barrier separates power and signal compartments.
- C. Housing Material: Die-cast aluminum, satin finished.
- D. Power Receptacle: NEMA WD 6, Configuration 5-20R, gray finish, unless otherwise indicated.
- E. Signal Outlet: Blank cover with bushed cable opening, unless otherwise indicated.

2.7 POKE-THROUGH ASSEMBLIES

- A. Description: Factory-fabricated and -wired assembly of below-floor junction box unit with multi-channeled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
 1. Size: Selected to fit nominal 3-inch (75-mm) cored holes in floor and matched to floor thickness.
 2. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
 3. Closure Plug: Arranged to close unused 3-inch (75-mm) cored openings and reestablish fire rating of floor.

2.8 MULTIOUTLET ASSEMBLIES

- A. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- B. Raceway Material: Metal, with manufacturer's standard finish.

2.9 FINISHES

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Color: Gray, unless otherwise indicated or required by Code.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install devices and assemblies plumb and secure.
- B. Install wall plates when painting is complete.
- C. Install wall dimmers to achieve indicated rating after derating for ganging as instructed by manufacturer.
- D. Do not share neutral conductor on load side of dimmers.
- E. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- F. Protect devices and assemblies during painting.
- G. Adjust locations at which floor service outlets and telephone/power service poles are installed to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

- A. Comply with Division 26 Section "Basic Electrical Materials and Methods."
 - 1. Switches: Where three or more switches are ganged, and elsewhere as indicated, identify each switch with approved legend engraved on wall plate.

3.3 CONNECTIONS

- A. Connect wiring device grounding terminal to outlet box with bonding jumper.
- B. Isolated-Ground Receptacles: Connect to isolated-ground conductor routed to designated isolated equipment ground terminal of electrical system.
- C. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

- A. Test wiring devices for proper polarity and ground continuity. Operate each device at least six times.
- B. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- C. Replace damaged or defective components.

3.5 CLEANING

- A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION 26 27 26

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 26: ELECTRICAL
Section 26 28 13 - Fuses

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

- 1. Fuses.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses from one source and by a single manufacturer.
- B. Comply with NFPA 70 for components and installation.
- C. Listing and Labeling: Provide fuses specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide fuses by one of the following:
 - 1. Cooper Industries, Inc.; Bussmann Div.
 - 2. General Electric Co.; Wiring Devices Div.
 - 3. Gould Shawmut.
 - 4. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

2.2 CARTRIDGE FUSES

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class as specified or indicated; current rating as indicated; voltage rating consistent with circuit voltage.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine utilization equipment nameplates and installation instructions to verify proper fuse locations, sizes, and characteristics.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

- A. Main Service: Class L, fast acting.
- B. Main Feeders: Class J, time delay.
- C. Motor Branch Circuits: Class RK1, time delay.
- D. Other Branch Circuits: Class RK5, non-time delay.

3.3 INSTALLATION

- A. Install fuses in fusible devices as indicated. Arrange fuses so fuse ratings are readable without removing fuse.

3.4 IDENTIFICATION

- A. Install typewritten labels on inside door of each fused switch to indicate fuse replacement information.

END OF SECTION 26 28 13

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 26: ELECTRICAL
Section 26 28 16 - Disconnect Switches

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes individually mounted switches used for the following:
 - 1. Feeder and equipment disconnect switches.
 - 2. Motor disconnect switches.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 26 Section "Fuses" for fuses in fusible disconnect switches.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for disconnect switches and accessories specified in this Section.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain disconnect switches from one source and by a single manufacturer.
- B. Comply with NFPA 70 for components and installation.
- C. Listing and Labeling: Provide disconnect switches specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide disconnect switches by one of the following:
 - 1. Switches:
 - a. General Electric Co.; Electrical Distribution and Control Division.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- b. Eaton
- c. Square D Co.

2.2 DISCONNECT SWITCHES

- A. Enclosed, Nonfusible Switch: NEMA KS 1, Type HD, with lockable handle.
- B. Enclosed, Fusible Switch, 800 A and Smaller: NEMA KS 1, Type HD, clips to accommodate specified fuses, enclosure consistent with environment where located, handle lockable with 2 padlocks, and interlocked with cover in CLOSED position.
- C. Enclosure: NEMA KS 1, Type 1, unless otherwise specified or required to meet environmental conditions of installed location.
 - 1. Outdoor Locations: Type 3R.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install disconnect switches in locations as indicated, according to manufacturer's written instructions.
- B. Install disconnect switches level and plumb.
- C. Connect disconnect switches and components to wiring system and to ground as indicated and instructed by manufacturer.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- D. Identify each disconnect switch according to requirements specified in Division 16 Section "Basic Electrical Materials and Methods."

3.2 FIELD QUALITY CONTROL

- A. Testing: After installing disconnect switches and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.5 for disconnect switches. Certify compliance with test parameters.
- B. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

3.3 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, and abrasions.

END OF SECTION 26 28

16 DISCONNECT

SWITCHES

26 28 16 – 2

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 26: ELECTRICAL
Section 26 32 13 - Packaged Engine Generators

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes packaged diesel-engine generator sets with the following features and accessories:
 - 1. Battery charger.
 - 2. Base mounted fuel tank.
 - 3. Engine generator set.
 - 4. Muffler.
 - 5. Exhaust piping external to set.
 - 6. Outdoor enclosure.
 - 7. Remote annunciator.
 - 8. Remote stop switch.
 - 9. Starting battery.
- B. Related Sections include the following:
 - 1. Division 26 Section "Transfer Switches" for transfer switches, including sensors and relays to initiate automatic-starting and -stopping signals for engine generator sets.

1.3 DEFINITIONS

- A. Standby Rating: Power output rating equal to the power the generator set delivers continuously under normally varying load factors for the duration of a power outage.
- B. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.
- C. Steady-State Voltage Modulation: The uniform cyclical variation of voltage within the operational bandwidth, expressed in Hertz or cycles per second.

1.4 SUBMITTALS

- A. Product Data: Include data on features, components, ratings, and performance. Include the following:
 - 1. Dimensioned outline plan and elevation drawings of engine generator set and other components specified.
 - 2. Thermal damage curve for generator.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Time-current characteristic curves for generator protective device.
- B. Shop Drawings: Indicate fabrication details, dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 1. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 2. Vibration Isolation Base Details: Signed and sealed by a qualified professional engineer. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.
 3. Wiring Diagrams: Detail wiring for power and control connections and differentiate between factory-installed and field-installed wiring.
- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- D. Field Test and Observation Reports: Indicate and interpret test results and inspection records relative to compliance with performance requirements.
- E. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
- F. Factory Test Reports: For units to be shipped for this Project, showing evidence of compliance with specified requirements.
- G. Sound measurement test report.
- H. Certification of Torsional Vibration Compatibility: Comply with NFPA 110.
- I. Field test report of tests specified in Part 3.
- J. Maintenance Data: For each packaged engine generator and accessories to include in maintenance manuals specified in Division 1. Include the following:
 1. Detail operating instructions for both normal and abnormal conditions.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Maintain a service center capable of emergency maintenance and repairs at the Project with eight hours' maximum response time.
- B. Source Limitations: Obtain packaged engine generator and auxiliary components specified in this Section through one source from a single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- D. Comply with NFPA 70.
- E. Comply with NFPA 110 requirements for Level 1 emergency power supply system.

1.6 DELIVERY, STORAGE, AND HANDLING

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Deliver engine generator set and system components to their final locations in protective wrappings, containers, and other protection that will exclude dirt and moisture and prevent damage from construction operations. Remove protection only after equipment is safe from such hazards.

1.7 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace packaged engine generator and auxiliary components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Caterpillar, Inc.; Engine Div.
 - 2. Kohler Co; Generator Division.
 - 3. Onan Corp; Industrial Business Group.

2.2 ENGINE GENERATOR SET

- A. Furnish a coordinated assembly of compatible components.
- B. Output Connections: 277/480 Volt, three phase, four wire.
- C. Safety Standard: Comply with ASME B15.1.
- D. Nameplates: Each major system component is equipped with a conspicuous nameplate of component manufacturer. Nameplate identifies manufacturer of origin and address, and model and serial number of item.
- E. Power Output Ratings: Nominal ratings as indicated, with capacity as required to operate as a unit as evidenced by records of prototype testing.
- F. Skid: Adequate strength and rigidity to maintain alignment of mounted components without depending on a concrete foundation. Skid is free from sharp edges and corners. Lifting attachments are arranged to facilitate lifting with slings without damaging any components.

2.3 GENERATOR-SET PERFORMANCE

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Steady-State Voltage Operational Bandwidth: 4 percent of rated output voltage from no load to full load.
- B. Steady-State Voltage Modulation Frequency: Less than 1 Hz.
- C. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage recovers to remain within the steady-state operating band within three seconds.
- D. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
- E. Steady-State Frequency Stability: When system is operating at any constant load within rated load, there are no random speed variations outside the steady-state operational band and no hunting or surging of speed.
- F. Transient Frequency Performance: Less than 5 percent variation for a 50 percent step-load increase or decrease. Frequency recovers to remain within the steady-state operating band within five seconds.
- G. Output Waveform: At no load, harmonic content measured line to line or line to neutral does not exceed 5 percent total and 3 percent for single harmonics. The telephone influence factor, determined according to NEMA MG 1, shall not exceed 50.
- H. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, the system will supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to any generator system component.
- I. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.4 SERVICE CONDITIONS

- A. Environmental Conditions: Engine generator system withstands the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
 - 1. Ambient Temperature: Minus 15 to plus 40 deg C.
 - 2. Altitude: Sea level to 1000 feet (300 m).

2.5 ENGINE

- A. Comply with NFPA 37.
- B. Fuel: Diesel.
- C. Rated Engine Speed: 1800 rpm.
- D. Maximum Piston Speed for Two-Cycle Engines: 1725 fpm (8.8 m/s).
- E. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm (11.4 m/s).
- F. Lubrication System: Pressurized by a positive-displacement pump driven from engine crankshaft. The following items are mounted on engine or skid:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
2. Thermostatic Control Valve: Controls flow in system to maintain optimum oil temperature. Unit is capable of full flow and is designed to be fail-safe.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps or siphons or special tools or appliances.

G. Engine Fuel System: Comply with NFPA 37. System includes the following:

1. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
2. Relief/Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

H. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment.

2.6 GOVERNOR

A. Type: Adjustable isochronous, with speed sensing.

2.7 ENGINE COOLING SYSTEM

A. Description: Closed loop, liquid cooled, with radiator factory mounted on engine generator-set skid and integral engine-driven coolant pump.

B. Radiator: Rated for specified coolant.

1. Radiator Core Tubes: Nonferrous-metal construction other than aluminum.
2. Fan: Driven by multiple belts from engine shaft.

C. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.

D. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.

E. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.

1. Rating: 50-psig (345-kPa) maximum working pressure with 180 deg F (82 deg C) coolant, and noncollapsible under vacuum.
2. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

2.8 FUEL SUPPLY SYSTEM

A. Comply with NFPA 30 and NFPA 37.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. Base-Mounted Fuel Oil Tank: Factory-installed and -piped, listed and labeled fuel oil tank. Features include the following:
 - 1. Tank level indicator.
 - 2. Capacity: Fuel for ninety-six (96) hours' continuous operation at 100 percent rated power output.
 - 3. Vandal-resistant fill cap.
 - 4. Containment Provisions: Comply with requirements of authorities having jurisdiction.
- C. Fuel Oil Piping and Remote Fuel Oil Storage Tank: As specified in Division 2 Section "Fuel-Oil Distribution."
- D. Interior Fuel Oil Piping: As specified in Division 23 Section "Fuel Oil Piping."

2.9 ENGINE EXHAUST SYSTEM

- A. Muffler: Critical type, sized as recommended by engine manufacturer. Measured sound level at a distance of **10 feet (3 m)** from exhaust discharge, is 85 dBA or less.
- B. Condensate Drain for Muffler: Schedule 40, black steel pipe connected to muffler drain outlet through a petcock.
- C. Connections from Engine to Exhaust System: Flexible section of corrugated stainless-steel pipe.
- D. Connection from Exhaust Pipe to Muffler: Stainless-steel expansion joint with liners.
- E. Exhaust Piping External to Engine: ASTM A 53, Schedule 40, welded, black steel, with welded joints and fittings. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping installation and joint construction. Refer to Division 23 Section "Hydronic Piping" for materials and installation requirements for piping.

2.10 STARTING SYSTEM

- A. Description: 12-V electric, with negative ground and including the following items:
 - 1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Environmental Conditions" Paragraph in "Service Conditions" Article above.
 - 2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
 - 3. Cranking Cycle: As required by NFPA 110 for system level specified.
 - 4. Battery: Adequate capacity within ambient temperature range specified in "Environmental Conditions" Paragraph in "Service Conditions" Article above to provide specified cranking cycle at least twice without recharging.
 - 5. Battery Cable: Size as recommended by generator set manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
 - 6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater is arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in "Environmental Conditions" Paragraph in "Service Conditions" Article above. Include accessories required to support and fasten batteries in place.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit complies with UL 1236 and includes the following features:
 - a. Operation: Equalizing-charging rate of 10 A is initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit then automatically switches to a lower float-charging mode and continues operating in that mode until battery is discharged again.
 - b. Automatic Temperature Compensation: Adjusts float and equalizes voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
 - c. Automatic Voltage Regulation: Maintains output voltage constant regardless of input voltage variations up to plus or minus 10 percent.
 - d. Ammeter and Voltmeter: Flush mounted in door. Meters indicate charging rates.
 - e. Safety Functions: Include sensing of abnormally low battery voltage arranged to close contacts providing low battery voltage indication on control and monitoring panel. Also include sensing of high battery voltage and loss of ac input or dc output of battery charger. Either condition closes contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
 - f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.11 CONTROL AND MONITORING

- A. Functional Description: When the mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic-transfer switches initiate starting and stopping of the generator set. When the mode-selector switch is switched to the on position, the generator set manually starts. The off position of the same switch initiates generator-set shutdown. When the generator set is running, specified system or equipment failures or derangements automatically shut down the generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down the generator set.
- B. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages are grouped on a common control and monitoring panel mounted on the generator set. Mounting method isolates the control panel from generator-set vibration.
- C. Indicating and Protective Devices and Controls: Include those required by NFPA 110 for a Level 1 system, and the following:
 1. AC voltmeter.
 2. AC ammeter.
 3. AC frequency meter.
 4. DC voltmeter (alternator battery charging).
 5. Engine-coolant temperature gage.
 6. Engine lubricating-oil pressure gage.
 7. Running-time meter.
 8. Ammeter-voltmeter, phase-selector switch(es).
 9. Generator-voltage adjusting rheostat.
 10. Fuel tank derangement alarm.
 11. Fuel tank high-level shutdown of fuel supply alarm.
- D. Supporting Items: Include sensors, transducers, terminals, relays, and other devices, and wiring required to support specified items. Locate sensors and other supporting items on engine,

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

generator, or elsewhere as indicated. Where not indicated, locate to suit manufacturer's standard.

- E. Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel. Locate audible device and silencing means where indicated.
- F. Remote Alarm Annunciator: Comply with NFPA 99. Labeled LEDs identify each alarm event. Common audible signal sounds for alarm conditions. Silencing switch in face of panel silences signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.
- G. Remote Emergency-Stop Switch: Flush wall-mounted, unless otherwise indicated and prominently labeled. Push button is protected from accidental operation.

2.12 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Generator Circuit Breakers: Molded-case, thermal-magnetic type; 100 percent rated; complying with NEMA AB 1 and UL 489.
 - 1. Tripping Characteristic: Designed specifically for generator protection.
 - 2. Trip Rating: Matched to generator rating.
 - 3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
 - 4. Mounting: Adjacent to or integrated with control and monitoring panel.

2.13 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1 and specified performance requirements.
- B. Drive: Generator shaft is directly connected to engine shaft. Exciter is rotated integrally with generator rotor.
- C. Electrical Insulation: Class H or Class F.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
- E. Construction prevents mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- F. Enclosure: Drip-proof.
- G. Instrument Transformers: Mounted within generator enclosure.
- H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
 - 1. Adjusting rheostat on control and monitoring panel provides plus or minus 5 percent adjustment of output-voltage operating band.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2.14 OUTDOOR GENERATOR-SET ENCLOSURE

- A. Description: Vandal-resistant, weatherproof steel housing, wind resistant up to 100 mph (160 km/h). Multiple panels are lockable and provide adequate access to components requiring maintenance. Panels are removable by one person without tools. Instruments and control are mounted within enclosure.
- B. Muffler Location: Within enclosure.
- C. Engine Cooling Airflow through Enclosure: Adequate to maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for two hours with ambient temperature at top of range specified in system service conditions.
- D. Louvers: Fixed-engine cooling air inlet and discharge. Louvers prevent entry of rain and snow.
- E. Dampers: At engine cooling air inlet and discharge. Dampers are closed to reduce enclosure heat loss in cold weather when unit is not operating.

2.15 FINISHES

- A. Outdoor Enclosures: Manufacturer's standard enamel over corrosion-resistant pretreatment and compatible standard primer.

2.16 SOURCE QUALITY CONTROL

- A. Factory Tests: Include prototype testing and Project-specific equipment testing (testing of equipment manufactured specifically for this Project).
- B. Prototype Testing: Performed on a separate engine generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
 - 1. Tests: Comply with those required for Level 1 energy converters in Paragraphs 3.2.1, 3.2.1.1, and 3.2.1.2 of NFPA 110.
 - 2. Generator Tests: Comply with IEEE 115.
 - 3. Components and Accessories: Items furnished with installed unit that are not identical to those on tested prototype have been tested to demonstrate compatibility and reliability.
- C. Project-Specific Equipment Tests: Factory test engine generator set and other system components and accessories before shipment. Perform tests at rated load and power factor. Include the following tests.
 - 1. Full load run.
 - 2. Maximum power.
 - 3. Voltage regulation.
 - 4. Transient and steady-state governing.
 - 5. Single-step load pickup.
 - 6. Safety shutdown.

PART 3 - EXECUTION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3.1 EXAMINATION

- A. Examine areas, equipment foundations, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine generator performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Examine roughing-in of cooling-system piping systems and electrical connections. Verify actual locations of connections before packaged engine generator installation.

3.2 CONCRETE BASES

- A. Install concrete bases of dimensions indicated for packaged engine generators. Refer to Division 3 Section "Cast-in-Place Concrete" and Division 26 Section "Basic Electrical Materials and Methods."

3.3 INSTALLATION

- A. Comply with packaged engine generator manufacturers' written installation and alignment instructions, and with NFPA 110.
- B. Set packaged engine generator set on concrete bases.
 - 1. Support generator-set mounting feet on rectangular metal blocks and shims or on metal wedges having small taper, at points near foundation bolts to provide **3/4- to 1-1/2-inch (19- to 38-mm)** gap between pump base and foundation for grouting.
 - 2. Adjust metal supports or wedges until generator is level.
- C. Install packaged engine generator to provide access for periodic maintenance, including removal of drivers and accessories.
- D. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.
 - 1. Verify that electrical wiring is installed according to manufacturers' submittal and installation requirements in Division 26 Sections. Proceed with equipment startup only after wiring installation is satisfactory.

3.4 CONNECTIONS

- A. Piping installation requirements are specified in Division 23 Sections. Drawings indicate general arrangement of piping and specialties. The following are specific connection requirements:
 - 1. Install piping adjacent to packaged engine generator to allow service and maintenance.
 - 2. Connect exhaust-system piping to diesel engines.
- B. Electrical wiring and connections are specified in Division 26 Sections.
- C. Ground equipment.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 IDENTIFICATION

- A. Identify system components according to Division 23 Section "Mechanical Identification" and Division 26 Section "Electrical Identification."

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections, and to assist in testing. Report results in writing.
- B. Testing: Perform field quality-control testing under the supervision of the manufacturer's factory-authorized service representative.
- C. Tests: Include the following:
 1. Tests recommended by manufacturer.
 2. InterNational Electrical Testing Association Tests: Perform each visual and mechanical inspection and electrical and mechanical test stated in NETA ATS for emergency engine generator sets, except omit vibration baseline test. Certify compliance with test parameters for tests performed.
 3. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, the following:
 - a. Single-step full-load pickup test.
 4. Battery Tests: Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery. Verify acceptance of charge for each element of battery after discharge. Verify measurements are within manufacturer's specifications.
 5. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
 6. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
 7. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
 8. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.
- D. Coordinate tests with tests for transfer switches and run them concurrently.
- E. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- F. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- G. Test instruments shall have been calibrated within the last 12 months, traceable to standards of the National Institute for Standards and Technology, and adequate for making positive observation of test results. Make calibration records available for examination on request.

3.7 COMMISSIONING

- A. Battery Equalization: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

3.8 CLEANING

- A. On completion of installation, inspect system components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish. Clean components internally using methods and materials recommended by manufacturer.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators as specified below:
 - 1. Coordinate this training with that for transfer switches.
 - 2. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment.
 - 3. Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."
 - 4. Schedule training with Owner, through Architect, with at least seven days' advance notice.
 - 5. Minimum Instruction Period: Four hours.

END OF SECTION 26 32 13

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 26: ELECTRICAL
Section 26 36 00: Transfer Switches

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes transfer switches rated 600 V and less, including the following:

- 1. Automatic transfer switch.
- 2. Remote annunciation system.

1.3 SUBMITTALS

- A. Product Data: Include ratings and dimensioned plans, sections, and elevations showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.
- B. Wiring Diagrams: Detail wiring for transfer switches and differentiate between manufacturer-installed and field-installed wiring. Show both power and control wiring.
- C. Product Certificates: Signed by manufacturer certifying that products furnished comply with requirements and that switches have been tested for load ratings and short-circuit closing and withstand ratings applicable to units for Project.
- D. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- E. Field Test Reports: Indicate and interpret test and inspection results for compliance with performance requirements.
- F. Maintenance Data: For each type of product to include in maintenance manuals specified in Division 1. Include all features and operating sequences, both automatic and manual. List all factory settings of relays and provide relay-setting and calibration instructions, including software, where applicable.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Maintain a service center capable of providing emergency maintenance and repairs at Project site with an eight-hour maximum response time.
- B. Source Limitations: Obtain automatic transfer switch and remote annunciator through one source from a single manufacturer.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, for emergency service under UL 1008, by a testing agency acceptable to authorities having jurisdiction.
- D. Comply with NEMA ICS 1.
- E. Comply with NFPA 70.
- F. Comply with NFPA 110.
- G. Comply with UL 1008, unless requirements of these Specifications are stricter.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Conventional Transfer Switches:
 - a. Caterpillar, Inc.; Engine Division.
 - b. Kohler Co.
 - c. Onan Corp.; Electrical Products Division.
 - d. Russelectric, Inc.
 - e. Zenith Controls, Inc.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

- A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
- B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
- C. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels have communications capability matched with remote device.
- D. Solid-State Controls: Repetitive accuracy of all settings is plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.
- E. Resistance to Damage by Voltage Transients: Components meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- F. Neutral Terminal: Solid and fully rated, unless otherwise indicated.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- G. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6; UL 508, unless otherwise indicated.
- H. Heater: Equip switches exposed to outdoor temperature and humidity conditions, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.
- I. Factory Wiring: Train and bundle factory wiring and label consistent with Shop Drawings, either by color code or by numbered or lettered wire and cable tape markers at terminations.
 - 1. Designated Terminals: Pressure type suitable for types and sizes of field wiring indicated.
 - 2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
 - 3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
- J. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.
- K. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - 1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
 - 2. Switch Action: Double throw; mechanically held in both directions.
 - 3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units rated 225 A and greater have separate arcing contacts.

2.3 AUTOMATIC TRANSFER SWITCHES

- A. Comply with Level 1 equipment according to NFPA 110.
- B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.
- C. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.
- D. Digital Communications Interface: Matched to capability of remote annunciator or annunciator and control panel.

2.4 AUTOMATIC TRANSFER-SWITCH FEATURES

- A. Undervoltage Sensing for Each Phase of Normal Source: Senses low phase-to-ground voltage on each phase. Pickup voltage is adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
- B. Time delay for override of normal-source voltage sensing delays transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
- C. Voltage/Frequency Lockout Relay: Prevents premature transfer to generator set. Pickup voltage is adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

Pickup frequency is adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.

- D. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes; factory set for 10 minutes. Provides automatic defeat of delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
- E. Test Switch: Simulates normal-source failure.
- F. Switch-Position Pilot Lights: Indicate source to which load is connected.
- G. Source-Available Indicating Lights: Supervise sources via transfer-switch, normal- and emergency-source sensing circuits.
 - 1. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - 2. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
- H. Unassigned Auxiliary Contacts: Two normally open single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
- I. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
- J. Engine Shutdown Contacts: Instantaneous. Initiates shutdown sequence at remote engine-generator controls after retransfer of load to normal source.
- K. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine-generator set and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
 - 1. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
 - 2. Push-button programming control with digital display of settings.
 - 3. Integral battery operation of time switch when normal control power is not available.

2.5 REMOTE ANNUNCIATOR SYSTEM

- A. Functional Description: Remote annunciator panel annunciates conditions for indicated transfer switches. Annunciation includes the following:
 - 1. Sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
 - 2. Switch position.
 - 3. Switch in test mode.
- B. Annunciator Panel: LED-lamp type with audible signal and silencing switch.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Indicating Lights: Grouped for each transfer switch monitored.
2. Label each group indicating transfer switch it monitors, location of switch, and identity of load it serves.
3. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.
4. Lamp Test: Push-to-test or lamp-test switch on front panel.

2.6 FINISHES

- A. Enclosures: Manufacturer's standard enamel over corrosion-resistant pretreatment and primer.

2.7 SOURCE QUALITY CONTROL

- A. Factory Test Components, Assembled Switches, and Associated Equipment: Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.
- B. Identify components according to Division 26 Section "Basic Electrical Materials and Methods."

3.2 WIRING TO REMOTE COMPONENTS

- A. Match type and number of cables and conductors to control and communications requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

3.3 CONNECTIONS

- A. Ground equipment as indicated and as required by NFPA 70.

3.4 FIELD QUALITY CONTROL

- A. Testing: Test transfer-switch products by operating them in all modes. Perform tests recommended by manufacturer under the supervision of manufacturer's factory-authorized service representative. Correct deficiencies and report results in writing. Record adjustable relay settings.
- B. Coordinate tests with tests of generator plant and run them concurrently.
- C. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3.5 CLEANING

- A. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean equipment internally, on completion of installation, according to manufacturer's written instructions.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain transfer switches and related equipment as specified below:
 - 1. Coordinate this training with that for generator equipment.
 - 2. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment.
 - 3. Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."
 - 4. Schedule training with Owner, through Architect, with at least seven days' advance notice.
 - 5. Provide a minimum of four hours of instruction.

END OF SECTION 26 36 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 26: ELECTRICAL
Section 26 51 00 – Interior Lighting

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes interior lighting fixtures, lighting fixtures mounted on exterior building surfaces, lamps, ballasts, emergency lighting units, and accessories.

1.3 SUBMITTALS

- A. Product Data: For each type of lighting fixture indicated, arranged in order of fixture designation. Include data on features, accessories, and the following:
 - 1. Dimensions of fixtures.
 - 2. Certified results of laboratory tests for fixtures and lamps for photometric performance.
 - 3. Emergency lighting unit battery and charger.
 - 4. Fluorescent and high-intensity-discharge ballasts.
 - 5. Types of lamps.

1.4 QUALITY ASSURANCE

- A. Fixtures, Emergency Lighting Units, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- B. Comply with NFPA 70.
- C. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.5 COORDINATION

- A. Fixtures, Mounting Hardware, and Trim: Coordinate layout and installation of lighting fixtures with ceiling system and other construction.

1.6 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. Special Warranty for Batteries: Written warranty, executed by manufacturer agreeing to replace rechargeable batteries that fail in materials or workmanship within specified warranty period.
 - 1. Special Warranty Period for Batteries: Manufacturer's standard, but not less than 5 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for last four years.
- C. Special Warranties for Fluorescent Ballasts: Written warranty, executed by manufacturer agreeing to replace fluorescent ballasts that fail in materials or workmanship within specified warranty period.
 - 1. Special Warranty Period for Electronic Ballasts: Five years from date of manufacture, but not less than four years from date of Substantial Completion.
 - 2. Special Warranty Period for Electromagnetic Ballasts: Manufacturers' standard warranty, but not less than two years from date of manufacture.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated in the Lighting Fixture Schedule on the drawings.

2.2 FIXTURES AND FIXTURE COMPONENTS, GENERAL

- A. Metal Parts: Free from burrs, sharp corners, and edges.
- B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- C. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.
- D. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
 - 4. Laminated Silver Metallized Film: 90 percent.
- E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.
 - 1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Lens Thickness: 0.15 inch minimum, unless greater thickness is indicated.

2.3 FLUORESCENT LAMP BALLASTS

- A. General Requirements: Unless otherwise indicated, features include the following:
 1. Designed for type and quantity of lamps indicated at full light output.
 2. Total Harmonic Distortion Rating: Less than 20 percent.
 3. Sound Rating: A.
- B. Electronic Ballasts for Linear Lamps: Unless otherwise indicated, features include the following, besides those in "General Requirements" Paragraph above:
 1. Certified Ballast Manufacturer Certification: Indicated by label.
 2. Encapsulation: Without voids in potting compound.
 3. Parallel Lamp Circuits: Multiple lamp ballasts connected to maintain full light output on surviving lamps if one or more lamps fail.
- C. Ballasts for Compact Lamps in Recessed Fixtures: Unless otherwise indicated, additional features include the following:
 1. Type: Electronic, fully encapsulated in potting compound.
 2. Power Factor: 90 percent, minimum.
 3. Operating Frequency: 20 kHz or higher.
 4. Flicker: Less than 5 percent.
 5. Lamp Current Crest Factor: Less than 1.7.
 6. Transient Protection: Comply with IEEE C62.41 for Category A1 locations.
 7. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
- D. Ballasts for Compact Lamps in Nonrecessed Fixtures: Unless otherwise indicated, additional features include the following:
 1. Power Factor: 90 percent, minimum.
 2. Ballast Coil Temperature: 65 deg C, maximum.
 3. Transient Protection: Comply with IEEE C62.41 for Category A1 locations.
 4. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
- E. Ballasts for Low-Temperature Environments: As follows:

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Temperatures **0 Deg F (Minus 17 Deg C)** and Above: Electronic type rated for **0 deg F (minus 17 deg C)** starting temperature.
2. Temperatures **Minus 20 Deg F (Minus 29 Deg C)** and Above: Electromagnetic type designed for use with high-output lamps.

F. Ballasts for Low Electromagnetic Interference Environments: Comply with 47 CFR, Chapter 1, Part 18, Subpart C for limitations on electromagnetic and radio-frequency interference for consumer equipment.

2.4 HIGH-INTENSITY-DISCHARGE LAMP BALLASTS

A. General: Comply with ANSI C82.4. Unless otherwise indicated, features include the following:

1. Type: Constant wattage autotransformer or regulating high-power-factor type, unless otherwise indicated.
2. Operating Voltage: Match system voltage.
3. Minimum Starting Temperature: **Minus 22 deg F (Minus 30 deg C)** for single lamp ballasts.
4. Normal Ambient Operating Temperature: **104 deg F (40 deg C)**.
5. Open-circuit operation that will not reduce average life.
6. Auxiliary, Instant-on, Quartz System: Automatically switches quartz lamp on when fixture is initially energized and when momentary power outages occur. Automatically turns quartz lamp off when high-intensity-discharge lamp reaches approximately 60 percent light output.

B. Encapsulation: Manufacturer's standard epoxy-encapsulated model designed to minimize audible fixture noise.

2.5 EXIT SIGNS

A. General Requirements: Comply with UL 924 and the following:

1. Sign Colors and Lettering Size: Comply with authorities having jurisdiction.

B. Internally Lighted Signs: As follows:

1. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum rated lamp life.

C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

1. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically energizes lamp from unit when circuit voltage drops to 80 percent of nominal or below. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2.6 EMERGENCY LIGHTING UNITS

- A. General Requirements: Self-contained units. Comply with UL 924. Units include the following features:
1. Battery: Sealed, maintenance-free, lead-acid type with minimum 10-year nominal life and special warranty.
 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 3. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.
 4. Wire Guard: Where indicated, heavy-chrome-plated wire guard arranged to protect lamp heads or fixtures.
 5. Integral Time-Delay Relay: Arranged to hold unit on for fixed interval after restoring power after an outage. Provides adequate time delay to permit high-intensity-discharge lamps to restrike and develop adequate output.

2.7 EMERGENCY FLUORESCENT POWER SUPPLY UNIT

- A. Internal Type: Self-contained, modular, battery-inverter unit factory mounted within fixture body. Comply with UL 924.
1. Test Switch and Light-Emitting Diode Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 2. Battery: Sealed, maintenance-free, nickel-cadmium type with minimum 10-year nominal life.
 3. Charger: Fully automatic, solid-state, constant-current type.
 4. Operation: Relay automatically energizes lamp from unit when normal supply circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamp, and battery is automatically recharged and floated on charger.

2.8 LAMPS

- A. Fluorescent Color Temperature and Minimum Color-Rendering Index: 3500 K and 85 CRI, unless otherwise indicated.
- B. Noncompact Fluorescent Lamp Life: Rated average is 20,000 hours at 3 hours per start when used on rapid-start circuits.
- C. Metal-Halide Color Temperature and Minimum Color-Rendering Index: 3600 K and 70 CRI, unless otherwise indicated.

2.9 FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Basic Electrical Materials and Methods," for channel- and angle-iron supports and nonmetallic channel and angle supports.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. Single-Stem Hangers: 1/2-inch (12-mm) steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch (12-mm) steel tubes with single canopy arranged to mount a single fixture. Finish same as fixture.
- D. Rod Hangers: 3/16-inch- (5-mm-) minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
- F. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

2.10 FINISHES

- A. Fixtures: Manufacturer's standard, unless otherwise indicated.
 - 1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
 - 2. Metallic Finish: Corrosion resistant.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials. Install lamps in each fixture.
- B. Support for Fixtures in or on Grid-Type Suspended Ceilings: Use grid for support.
 - 1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches (150 mm) from fixture corners.
 - 2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner.
 - 3. Fixtures of Sizes Less Than Ceiling Grid: Arrange as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
- C. Suspended Fixture Support: As follows:
 - 1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 - 3. Continuous Rows: Suspend from cable installed according to fixture manufacturer's written instructions and details on Drawings.

3.2 CONNECTIONS

- A. Ground equipment.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Tests: As follows:
 1. Verify normal operation of each fixture after installation.
 2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation.
 3. Verify normal transfer to battery source and retransfer to normal.
- C. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.
- D. Corrosive Fixtures: Replace during warranty period.

3.4 CLEANING AND ADJUSTING

- A. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.
- B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION 26 51 00

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 26: ELECTRICAL

Section 27 05 25 - Communication and Data-Processing Equipment

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes wire, cable, connecting devices, installation, and testing for wiring systems to be used as signal pathways for voice and high-speed data transmission. Contractor shall add components required to existing cabinets/racks to achieve data connectivity to the locations indicated on the plans.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. IDC: Insulation displacement connector.
- C. LAN: Local area network.
- D. PVC: Polyvinyl chloride.
- E. STP: Shielded twisted pair.
- F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

- A. Product Data: Include data on features, ratings, and performance for each component specified.
- B. Shop Drawings: Include dimensioned plan and elevation views of components.
 - 1. System labeling schedules, including electronic copy of labeling schedules, as specified in Part 3, in software and format selected by Owner.
- C. Product Certificates: Signed by manufacturers of cables, connectors, and terminal equipment certifying that products furnished comply with requirements.
- D. Qualification Data: For firms and persons specified in "Quality Assurance" Article. Provide evidence of applicable registration or certification.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- E. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- F. Maintenance Data: For products to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: To be qualified to bid on this project, the contractor shall have successfully completed a minimum of ten (10) projects for installation of Category 6 unshielded twisted pair cable.
- B. Comply with NFPA 70.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 COORDINATION

- A. Coordinate Work of this Section with Owner's telephone switch and LAN equipment suppliers. Coordinate service entrance arrangement with local exchange carrier.
 - 1. Meet jointly with representatives of above organizations and Owner's representatives to exchange information and agree on details of equipment arrangements and installation interfaces.
 - 2. Record agreements reached in meetings and distribute record to other participants.
 - 3. Adjust arrangements and locations of distribution frames and patch panels in equipment rooms and wiring closets to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cable:
 - a. Belden Wire & Cable Company.
 - b. Berk-Tek
 - c. Lucent Technologies, Inc.; Network Systems.
 - d. Siecor Corp.
 - 2. Terminal and Connector Components and Distribution Racks:
 - a. AMP, Inc.
 - b. Chatsworth
 - c. Hubbell Premise Wiring, Inc.
 - d. Leviton Mfg. Co., Inc.; Telcom Division.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- e. Lucent Technologies, Inc.; Network Systems.
- f. Ortronics
- g. Siecor Corp.

2.2 SYSTEM REQUIREMENTS

- A. General: Coordinate the features of materials and equipment so they form an integrated system. Match components and interconnections for optimum future performance.
- B. Expansion Capability: Unless otherwise indicated, provide spare positions in patch panels and space in backbone cable trays and wireways to accommodate 20 percent future increase in active workstations.
- C. The cabling system shall allow the owner to transmit up to speeds of 100 Mbs plus.

2.3 MOUNTING ELEMENTS

- A. Raceways and Boxes: Comply with Division 26 Section "Raceways and Boxes."

2.4 TWISTED-PAIR CABLES, CONNECTORS, AND TERMINAL EQUIPMENT

- A. Listed as complying with Categories 6 of EIA/TIA-568-A.
- B. Conductors: Solid copper.
- C. UTP Cable: Comply with EIA/TIA-568-B. Four thermoplastic-insulated, individually twisted pairs of conductors; No. 24 AWG, color-coded; data cables enclosed in orange PVC jacket and voice cables in a blue PVC jacket. Berk-Tek or equal.
- D. UTP Cable Connecting Hardware: Comply with EIA/TIA-568-B. IDC type, using modules designed for punch-down caps or tools.
 - 1. IDC Terminal Block Modules: Integral with connector bodies, including plugs and jacks where indicated.
 - 2. IDC Connecting Hardware: Consistent throughout Project.
- E. Patch Panel: Modular panels housing multiple, numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables. Equal to 48 port patch panel by Ortronics.
 - 1. Number of Jacks per Field: One for each four-pair conductor group of indicated cables, plus spares and blank positions adequate to satisfy specified expansion criteria.
 - 2. Mounting: Rack.
- F. Jacks and Jack Assemblies for UTP Cable: Modular, color-coded, RJ-45 receptacle units with integral IDC-type terminals. Use keyed jacks for data service. As manufactured by Ortronics or equal.
- G. Workstation Outlets: Dual jack-connector assemblies mounted in single or multigang faceplate.
 - 1. Faceplate: Stainless steel.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Mounting: Flush, unless otherwise indicated.
3. Legend: Factory label by silk-screening or engraving.

2.5 IDENTIFICATION PRODUCTS

- A. Comply with Division 26 Section "Basic Electrical Materials and Methods" and the following:
 1. Cable Labels: Self-adhesive vinyl wraparound tape markers, machine printed with alphanumeric cable designations.

PART 3 - EXECUTION

3.1 GENERAL

- A. All Category 6 cable, data jacks and faceplates, patch panels, outlet boxes, conduit, cable support hardware, sleeves, etc. as required to complete the installation described in these specifications and the drawings shall be supplied and installed by this contractor.

3.2 EXAMINATION

- A. Examine pathway elements intended for cable. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 APPLICATION OF MEDIA

- A. Horizontal Cables for Data Service: Use UTP cable complying with Category 6 of EIA/TIA-568-A for runs between wiring closets and workstation outlets.
- B. Horizontal Cables for Voice Service: Use UTP cable complying with Category 6 of EIA/TIA-568-A for runs between wiring closets and workstation outlets.

3.4 CATEGORY 6 CABLE INSTALLATION

- A. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces where cable wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including under raised access flooring and plenum ceilings. Conceal raceway and wiring except in unfinished spaces.
- B. Install cable using techniques, practices, and methods that are consistent with Category 6 rating of components and that ensure Category 6 performance of completed and linked signal paths, end to end.
- C. Install cable without damaging conductors, shield, or jacket.
- D. Do not bend cable in handling or in installing to smaller radii than minimums recommended by manufacturer.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- E. Pull cables without exceeding cable manufacturer's recommended pulling tensions.
 - 1. Pull cables simultaneously if more than one is being installed in the same raceway.
 - 2. Use pulling compound or lubricant if necessary. Use compounds that will not damage conductor or insulation.
 - 3. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage media or raceway.
- F. Install exposed cable parallel and perpendicular to surfaces or exposed structural members, and follow surface contours where possible.
- G. Secure and support cable at intervals not exceeding 48 inches with J-hooks or cable tray and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
- H. Wiring within Wiring Closets and Enclosures: Provide adequate length of conductors. Train conductors to terminal points with no excess. Use lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
- I. Separation of Wires: Comply with EIA/TIA-569 rules for separating unshielded copper communication and data-processing equipment cables from potential EMI sources, including electrical power lines and equipment.
- J. Cables shall be routed in groups of similar types. (i.e. data outlet cables grouped together, fiber optic cables grouped together, etc.)
- K. Horizontal cabling routed above ceilings shall be supported using the following methods.
 - 1. Cables supported on J-hooks designed specifically for this purpose. Support J-hooks from structure with threaded rod. Hang J-hooks approximately two feet above the lay-in ceiling.
 - 2. Cables independently supported using cabling clips attached to the ceiling structure or slab.
- L. All cable shall be neatly routed along one side of the corridor. Branch out across the corridors as necessary to serve the individual rooms. Cabling shall be routed in a manner which will allow the owner to maintain access to the cables, electrical systems and HVAC equipment above the ceiling. Maintainability of all systems above the ceiling is critical.
- M. All cables shall be bundled and wrapped together with velcro straps. Strapping shall occur on four foot intervals throughout the space. Straps should not bite into the cable, but should form loosely around the cables as not to depress the cable.
- N. Cables above the corridor ceiling shall be supported using cable tray and wall mounted J-hooks equal to Caddy CAT32 with any necessary attachment hardware.
- O. Cables shall be routed into conduits stubbed up above the ceiling from each outlet (bushing on end of conduit). Cabling shall be routed in conduit above non-accessible ceilings.
- P. All cables shall pass acceptable test requirements and levels as detailed in the "Field Quality Control" section of these specifications. Contractor to remedy any cabling problems or defects in order to pass or comply with testing. This includes terminations and the re-pull on new cable as required at no additional cost to the owner.
- Q. Cables shall not be spliced.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- R. Ends of cables shall be terminated by the contractor on both ends unless otherwise noted.
- S. Provide proper temporary protection of cable after pulling is complete before final dressing and terminations are complete. Do not leave cable laying on floor. Bundle and tie wrap up off of the floor.
- T. Contractor shall insure that cabling is a minimum of 5" away from all light fixtures.
- U. Contractor shall install sleeves with bushings as necessary in walls for routing cables to the outlets. Install a minimum of three (3) 3" sleeves with bushings for the MDF. Firestop all firewall penetrations.
- V. When cables turn down below ceiling at the MDF/IDF, contractor shall install sleeves through the lay-in ceiling (bushing on each end). Cutting a hole in the ceiling tile is not acceptable.
- W. Install a J-hook directly above the drop to every outlet. Bundle and tie wrap up 5' of slack cable prior to entering the wall.
- X. Cable Terminations
 - 1. Terminations shall be made in accordance with EIA TIA 568B standard.
 - 2. Terminations shall be RJ45 type.
 - 3. Route individual four pair category 6 cable to the backside of each patch panel and punch down onto a port. Label each port on the front and rear of each panel.
 - 4. Maintain twists of each pair to the punch down point. Do not strip more than one-half inch of insulation from the cable at termination points.
- Y. Outlets
 - 1. Install outlets per manufacturer's instructions and recommendations.
 - 2. Install and terminate all UTP cabling at each outlet as per manufacturer's instructions and recommendations.
 - 3. Provide an outlet label on each cover plate and inside each wall box.
 - 4. Leave at least 12" of slack cable at each outlet.

3.5 GROUNDING

- A. Comply with Division 26 Section "Grounding."
- B. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- C. Bond shields and drain conductors to ground at only one point in each circuit.
- D. Signal Ground Terminal: Locate in each equipment room and wiring closet. Isolate from power system and equipment grounding.
- E. Signal Ground Bus: Mount on wall of main equipment room with standoff insulators.
- F. Signal Ground Backbone Cable: Extend from signal ground bus to signal ground terminal in each wiring closet and equipment room.

3.6 INSTALLATION IN EQUIPMENT ROOMS AND WIRING CLOSETS

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Mount patch panels and other connecting hardware on racks, unless otherwise indicated.
- B. Group connecting hardware for cables into separate logical fields.
- C. Use patch panels to terminate cables entering the space, unless otherwise indicated.

3.7 IDENTIFICATION

- A. Identify system components complying with applicable requirements in Division 26 Section "Basic Electrical Materials and Methods" and the following Specifications.
- B. General
 - 1. All labels shall have an adhesive backing for permanent attachment.
 - 2. All labels shall be of sufficient size. Minimum size shall be 1½" W x 3/16" H for outlets, outlet cables and patch panels.
- C. Installation
 - 1. Install labels straight.
 - 2. Install labels at locations previously specified and as follows:
 - a. Outlet faceplates.
 - b. Inside of outlet box.
 - c. Outlet cable inside box.
 - d. Outlet cable in ceiling above outlet.
 - e. Outlet cable at rear of patch panel.
 - f. Front and rear of patch panels.
- D. Text Size and Information
 - 1. Text shall be as large and bold as possible.
 - 2. All outlets and outlet cables shall contain the outlet number, room number, MDF/IDF number, patch panel number and port number.
- E. Within Connector Fields, in Wiring Closets and Equipment Rooms: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both communication and data-processing equipment, use a different color for jacks and plugs of each service.
- F. Cables, General: Label each cable within **4 inches (100 mm)** of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
- G. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding **15 feet (4.5 m)**.
- H. Cable Schedule: Post in prominent location in each wiring closet and equipment room. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Provide electronic copy of final comprehensive schedules for Project, in software and format selected by Owner.

3.8 FIELD QUALITY CONTROL

- A. General

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. The following cabling systems shall be tested after installation is fully completed.
 - a. Data outlet cabling from each outlet to the patch panel port, including test patch cables.
 2. Testing shall follow EIA TIA 568, TSB 36 and TSB 40 standards.
- B. Testing: On installation of cable and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.
1. Copper Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Use Class 2 bidirectional Category 6 tester. Test for faulty connectors, splices, and terminations. Test according to EIA/TIA-TSB 67, "Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems." Link performance for UTP cables must meet minimum criteria of EIA/TIA-568-A.
- C. Category 6 Cable Testing
1. Cable testing shall be performed with a Micro-Test Pentascanner Plus or equivalent test unit. Test unit shall be capable of providing a Level 2 accuracy test and have a category 6 printout.
 2. Each outlet/cable shall be tested and certified. Each pair of the end to end system shall be tested. End to end is from the outlet RJ45 port through the RJ45 port at the Category 6 data patch panel. A 10' patch cable shall be used at the patch panel end and a 3' patch cable shall be used at the outlet end so that the outlet, outlet termination, cable, patch panel termination, patch cables and patch panel port can be seen in the test.
 3. Test results shall be positive and favorable. End to end attenuation loss and near end cross talk shall meet or exceed category 6, EIA/TIA 568, TSB 36 requirements.
 4. If a problem or failed test occurs, the contractor shall evaluate and remedy the problem. After a problem has been remedied, the contractor shall re-test the circuit and analyze test results. The contractor shall continue this process until the cable passes all tests.
 5. Each outlet/cable test shall include:
 - a. Overall cable length
 - b. System continuity
 - c. Proper connectivity
 - d. Open pairs
 - e. Short circuits
 - f. Reversed pairs
 - g. EMI noise induction
 - h. Damaged cable
 - i. Stretched, chinked or crimped cable
 - j. Attenuation loss in dB
 - k. Near end cross talk in dB
 6. Provide the owner with three (3) copies of the test units results for all cables.
- D. Correct malfunctioning units at project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

3.9 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3.10 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain systems.
 - 1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
 - 2. Train designated personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and extending wiring to establish new workstation outlets.
 - 3. Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."
 - 4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 27 05 25

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 28 SECURITY ELECTRONICS
Section 28 05 13.13 CLOSED CIRCUIT TELEVISION SYSTEM (CCTV) MODIFICATIONS AND
UPGRADE

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.02 SUMMARY (See General Summary of Work, Section 28 40 00)

- A. This section of the specifications requires the complete installation of the new Closed Circuit Television System (CCTV) as indicated on the drawings and/or specified herein. Provide all labor, materials, equipment and supervision to install, check out, adjust and calibrate the total system including new and existing cameras. All pictures shall be clear and free of snow, ground loops, or other conditions that will degrade the picture. When video switchers are used, when switching from camera to camera no delay shall exist and no roll or static shall be noted on the monitors. Cameras shall be displayed on area monitors in a specific area and all cameras shall be displayed from the matrix switcher to all administrative area CCTV equipment.
- B. The work shall consist of the installation of new complete closed circuit television system consisting essentially of, but not limited to , the following major components;
1. Remote Cameras, including lens, housings, motion operators, and mounting devices.
 2. Monitors with mounting devices for installation where indicated
 3. Signal conditioning equipment for rack mounting
 4. Remote camera motion control system for rack mounting
 5. Equipment mounting racks and cabinets
 6. System wiring
 7. Interface existing and new components with new Touchscreen Control elements.
- C. The basic operation of this system shall be accomplished through the use of a microprocessor-Based switcher. All camera and control signals shall be interconnected with the headend switcher unit located where shown on the plans. All remote locations which indicate a color monitor shall also be equipped with programmable switcher and motion control equipment for manipulating the associated cameras and control signals. All CCTV equipment shall support full color signals.
- D. Video Surveillance Automated Call-Up:
1. The video surveillance system shall be configured for automatic camera viewing on selected intercom calls and alarms upon acknowledgment by the control operator.
- E. The CCTV system shall have remote monitoring and control locations as shown on the one-line diagram or as shown on drawings. These remote locations shall contain color monitors sized as required by the plans and programmable switchers, as indicated.
1. ACCEPTABLE MANUFACTURERS Except as otherwise specified herein, the equipment and material of this Section shall be products of the following manufacturers. Product descriptions have been taken from Bosch products and are meant to set a standard for quality only.
 - a. Bosch, Lancaster, PA
 - b. Pelco, Clovis, CA
 - c. Vicon, NY
 2. RELATED WORK SPECIFIED ELSEWHERE
 - a. The work of this Section is related to the work of the following Sections:
 - 1) General Provisions
 - 2) PLC System

ALTERATIONS AND ADDITIONS
TO THE CALHOUN COUNTY JAIL
CALHOUN COUNTY, ALABAMA

- 3). Theory of Operation - Graphic Control Panels and Touch Screen Control Stations
- 4) Uninterruptible Power Supply System

PART 2 PRODUCTS

1.0 SYSTEM REQUIREMENTS

- A. General: For new system, provide a complete and fully functional CCTV System using materials and equipment of types, sizes, and rating, as required to meet performance requirements specified herein. Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction, in accordance with published product information. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions and interfaced with existing systems for complete operational compatibility..
- B. The system shall consist of cameras, lenses, and monitors, mounting hardware, housings, switchers, signal generating, processing equipment, digital video recorders, amplifiers and video management system.
- C. The system shall permit visual monitoring, surveillance and recording of areas automatically based on events via the PLC for intercom and door alarms.
- D. NEC Compliance. Comply with applicable requirements pertaining to TV equipment and signal distribution systems.
- E. UL Compliance. Comply with applicable requirements of UL safety standards pertaining to television equipment and accessories. Provide TV equipment and accessories, which are UL-listed and labeled.
- F. EIA Compliance. Comply with applicable requirements of Electronic Industries Associations standards pertaining to television cameras and monitors.

1.01 CAMERAS (ALL NEW CAMERAS WITHIN THE NEW SYSTEM AS SHOWN ON DRAWINGS SHALL BE EQUAL TO THE FOLLOWING:

A. MINIDOME CAMERAS

1. The Vandal resistant 1080P HD camera shall have a microSD card slot that uses standard; off-the-shelf microSD (SDHC and SDXC) cards for local storage (up to 2 TB) and be enclosed in a cast-aluminum housing with an aluminum trim ring and a clear polycarbonate dome bubble (with UV blocking anti-scratch coating) and a hardened inner liner and be capable of operating in an indoor or an outdoor environment.
2. Image Sensor: 1/2.7-inch CMOS HD image sensor.
3. Lens: 3-9mm or 10-23mm motorized automatic zoom and focus (remote varifocal), super resolution lenses with an advanced iris design.
4. Camera processing latency: <55 ms
5. Dynamic Range: up to 120 dB
6. Audio
 - a. Standard:
 - 1) AAC
 - 2) G.711, 8 kHz sampling rate
 - 3) C.L16, 16 kHz sampling rate
7. Signal-to-Noise Ratio: >50 dB
8. Audio Streaming: Full duplex / Half duplex

ALTERATIONS AND ADDITIONS
TO THE CALHOUN COUNTY JAIL
CALHOUN COUNTY, ALABAMA

9. Light sensitivity (based on 3100K, Scene Reflectivity 89%, 1/25, F1.4, 30 IRE)
10. Starlight mode:
 - a. Color: 0.0075 lx
 - b. Monochrome: 0.0011 lx
11. HDR mode:
 - a. Color: 0.044 lx
 - b. Monochrome: 0.015 lx
12. Content-based Imaging Technology (C-BIT) and Intelligent Dynamic Noise Reduction (iDNR) technology to reduce the bitrate and storage requirements by removing noise artifacts.
13. Resolution: 1920 x 1080 pixels (HD 1080p) at 60 ips with a 16:9 image format, 1080 x 1920, 1280 x 960 pixels (1.3MP) with a 4:3 image format, 1280 x 720 pixels (HD 720p) 16:9 image format and D1 resolution of 704 x 480 pixels at 30 ips with a 4:3 image format.
14. Network:
 - a. Protocols: IPv4, IPv6, UDP, TCP, HTTP, HTTPS, RTP, IGMP V2/V3, ICMP, RTSP, FTP, Telnet, ARP, DHCP, SNTP, SNMP (V1, MIB-II), 802.1x, SMTP, iSCSI, UPnP (SSDP)
 - b. Encryption: TLS 1.0, SSL, AES (optional)
 - c. Ethernet: STP, 10/100 Base-T, auto-sensing, half/full duplex, RJ45
 - d. PoE Supply: IEEE 802.3at Type-2 compliant
15. Connectivity:
 - a. ONVIF Profile S
 - b. Auto-MDIX
16. Edge Essential Video Analytics
 - a. Configurations:
 - 1) Silent VCA / Profile1/2 / Scheduled / Event Triggered
 - b. Alarm rules (combinable):
 - 1) Any object / Object in Field / Line Crossing / Enter/Leave field Loitering / Follow route / idle/remove object / Counting / Occupancy / Crowd density estimation / Condition change / similarity search
17. Operating Temperature: -30°C to +50°C (-22°F to 122°F)
18. Cold Start Temperature: -20°C (-4°F)
19. Operating Humidity: 5% to 93% relative humidity
20. Water/Dust Protection: IP66 and NEMA Type 4X
21. Impact Protection: IK10

B. 5MP MINIDOME CAMERAS

1. The Vandal resistant 5MP camera shall have a microSD card slot that uses standard; off-the-shelf microSD (SDHC and SDXC) cards for local storage (up to 2 TB) and be enclosed in a cast-aluminum housing with an aluminum trim ring and a clear polycarbonate dome bubble (with UV blocking anti-scratch coating) and be capable of operating in an indoor or an outdoor environment.
2. Image Sensor: 1/2.9-inch CMOS image sensor.

ALTERATIONS AND ADDITIONS
TO THE CALHOUN COUNTY JAIL
CALHOUN COUNTY, ALABAMA

3. Lens: 3-10mm motorized automatic zoom and focus (remote varifocal) lens with an advanced iris design. Horizontal field of view shall be 29 to 92 degrees and vertical field of view shall be 18 to 50 degrees minimum.
4. Camera processing latency: <55 ms
5. Dynamic Range: 120 dB HDR
6. Compression: H.265 MP, H.264 MP, M-JPEG
7. Audio
 - a. Standard:
 - 1) AAC
 - 2) G.711, 8 kHz sampling rate
 - 3) L16, 16 kHz sampling rate
 - b. Signal-to-Noise Ratio: >50 dB
 - c. Audio Streaming: Full duplex / Half duplex
8. Light sensitivity (based on 3100K, Scene Reflectivity 89%, 1/25, F1.4, 30 IRE)
 - a. Color: 0.24 lx
 - b. Monochrome: 0.03 lx
9. Content-based Imaging Technology (C-BIT), Intelligent streaming and Intelligent Dynamic Noise Reduction (iDNR) technology to reduce the bitrate and storage requirements by removing noise artifacts.
10. Resolution: 3071 x 1728 pixels (MP 5MP) at 30 fps with a 16:9 image format, 2688 x 1512 pixels (MP 4MP) at 30 fps with a 16:9 image format, 2304 x 1296 pixels (MP 3MP) at 30 fps with a 16:9 image format and 1920 x 1080 (HD 1080P) at 30 fps with a 16:9 image format.
11. Network:
 - a. Protocols: IPv4, IPv6, UDP, TCP, HTTP, HTTPS, RTP/RTCP, IGMP V2/V3, ICMP, ICMPv6, RTSP, FTP, Telnet, ARP, DHCP, SNMP, SNTP, SNMP (V1, MIB-II), 802.1x, DNS, DNSv6, DDNS, SMTP, iSCSI, UPnP (SSDP), DiffServ (QoS), LLDP, SOAP, Dropbox, CHAP, Digest Authentication.
 - b. Encryption: TLS 1.0, SSL, AES (optional)
 - c. Ethernet: STP, 10/100 Base-T, auto-sensing, half/full duplex, RJ45
 - d. PoE Supply: IEEE 802.3af compliant
12. Connectivity:
 - a. ONVIF Profile S
 - b. Auto-MDIX
13. Edge Essential Video Analytics
 - a. Configurations:
 - 1) Silent VCA / Profile1/2 / Scheduled / Event Triggered
 - b. Alarm rules (combinable):
 - 1) Any object / Object in Field / Line Crossing / Enter/Leave field / Loitering / Follow route / idle/remove object / Counting / Occupancy / Crowd density estimation / Condition change /similarity search
14. Operating Temperature: -40°C to +50°C (-40°F to 122°F)
15. Operating Humidity: 0% to 90% relative humidity
16. Water Protection: IP66
17. Impact Protection: IK10

ALTERATIONS AND ADDITIONS
TO THE CALHOUN COUNTY JAIL
CALHOUN COUNTY, ALABAMA

C. MAXIMUM SECURITY CELL CORNER CAMERA

1. The ruggedized, vandal resistant HD POE camera shall be a corner mount, no-grip design with a microSD card slot that uses standard; off-the-shelf microSD (SDHC and SDXC) cards for local storage (up to 2 TB) and be enclosed in a cast-aluminum housing. It shall be able to view the entire floor and all four walls of a 15 foot square room, including the two walls to which it is attached and have a night-time IR monochrome mode and built in IR illuminators.
2. Image Sensor: 1/2.7-inch CMOS HD image sensor with mechanical filter technology for vivid daytime color and effective night-time performance under infrared illumination.
3. Lens: 2.0 allowing a full 121° H-FoV and 91° V-FoV of the entire room.
4. Overall IP Delay: Min. 120 ms, Max. 240 ms
5. Dynamic Range: 69 dB
6. Audio
 - a. Standard:
 - 1) AAC
 - 2) G.711, 8 kHz sampling rate
 - 3) L16, 16 kHz sampling rate
 - b. Signal-to-Noise Ratio: >50 dB
 - c. Audio Streaming: Full duplex / Half duplex
7. Light sensitivity (based on 3200K, Scene Reflectivity 89%, 30 IRE)
 - a. Color: 0.3 lx (0.03 fc)
 - b. Monochrome: 0.0 lx (IR on)
8. Content-based Imaging Technology (C-BIT) and Intelligent Dynamic Noise Reduction (iDNR) technology to reduce the bitrate and storage requirements by removing noise artifacts.
9. Resolution: 1440 x 1080 pixels (HD 1080p) at 30 ips with a 16:9 image format.
10. Network:
 - a. Protocols: IPv4, IPv6, UDP, TCP, HTTP, HTTPS, RTP, IGMP V2/V3, ICMP, RTSP, FTP, Telnet, ARP, DHCP, SNTP, SNMP (V1, MIB-II), 802.1x, SMTP, iSCSI, UPnP (SSDP)
 - b. Encryption: TLS 1.0, SSL, AES (optional)
 - c. Ethernet: STP, 10/100 Base-T, auto-sensing, half/full duplex, RJ45
 - d. PoE Supply: IEEE 802.3af Type-1 compliant
11. Connectivity:
 - a. ONVIF Profile S
 - b. Auto-MDIX
12. Operating Temperature: -10°C to +50°C (14°F to 122°F)
13. Operating Humidity: 20% to 90% relative humidity
14. Water/Dust Protection: IP65
15. Impact Protection: IK10

D. 5MP 360 DEGREE PANORAMIC CAMERA

1. The 360 degree panoramic camera shall offer Content-based Imaging Technology (CBIT), utilize Intelligent Dynamic Noise Reduction (iDNR) technology to reduce the bitrate and

ALTERATIONS AND ADDITIONS
TO THE CALHOUN COUNTY JAIL
CALHOUN COUNTY, ALABAMA

- storage requirements by removing noise artifacts, and accept power via Power over Ethernet (IEEE 802.3af compliant).
2. The camera shall offer a 1/3-inch CMOS image sensor, 5MP sensor pixels (3.33MP optical circle at 15FPS).
 3. The camera shall provide direct network connection, allow full camera control and configuration capabilities over the network, be capable of capturing and storing images using the following compression standards:
 - a. H.264 MP (Main Profile)
 - b. M-JPEG
 4. The camera shall deliver video over a 10/100 Base-T, auto-sensing, half/full duplex, RJ45 Ethernet connection, comply with the IEEE 802.3af
 5. The camera shall be capable of processing and analyzing video within the camera itself, with no extra hardware required, be capable of detecting and sending alarms for abnormal events, and allow users to set up separate profiles, and switch profiles based on day/night or holiday schedules.
 6. The camera shall offer three levels of password protection, support 802.1x authentication using a RADIUS (Remote Authentication Dial In User Service) server, store a SSL certificate for use with HTTPS, and be capable of being independently AES encrypted with 128-bit keys.
 7. The camera shall support iSCSI devices to allow video stream to be recorded directly to an iSCSI RAID array, support iSCSI storage targets to enable the camera to function as a conventional DVR, have a microSD card slot that uses standard; off-the-shelf microSD (SDHC and SDXC) cards for local storage (up to 2 TB), and the local storage feature shall be capable of storage for Automatic Network Replenishment (ANR).
 8. The camera shall have an integrated omni-directional microphone, offer two-way, full duplex audio communication, and offer G.711, AAC and L16 audio compression (live and recording).
 9. The camera shall provide a full circle image as well as two distortion-free channels with their own streams. One of these channels is an E-PTZ channel which is always available. Viewing options for the second channel shall include double panorama, E-PTZ, North/South/East/West and Corridor view.
 10. The camera shall be ONVIF Profile S compliant to allow integration with third-party client-side dewarping software.
 11. IP66 weatherproof rating and IK10 vandal resistance rating.
 12. Operating Temperature: -20°C to +50°C (-4°F to 122°F)
- E. 12MP 180/360 DEGREE PANORAMIC CAMERA (EXTERIOR/VANDAL HOUSING AVAILABLE BY OTHERS)
1. The panoramic camera shall be available in an indoor 180 degree or 360 degree model, offer Content-based Imaging Technology (CBIT), utilize Intelligent Dynamic Noise Reduction (iDNR) technology to reduce the bitrate and storage requirements by removing noise artifacts, accept power via Power over Ethernet (IEEE 802.3af compliant), and offer optional Intelligent Video Analysis (IVA).
 2. The camera shall offer a 1/2.3-inch CMOS image sensor, 12MP sensor pixels (9.55MP optical circle for 180 camera and 5.49MP optical circle for 360 camera).
 3. The camera shall provide direct network connection, allow full camera control and configuration capabilities over the network, be capable of capturing and storing images using the following compression standards:
 - a. H.264 MP (Main Profile)

ALTERATIONS AND ADDITIONS
TO THE CALHOUN COUNTY JAIL
CALHOUN COUNTY, ALABAMA

b. M-JPEG

4. The camera shall deliver video over a 10/100 Base-T, auto-sensing, half/full duplex, RJ45 Ethernet connection, comply with the IEEE 802.3af
5. The camera shall be capable of processing and analyzing video within the camera itself, with no extra hardware required, be capable of detecting and sending alarms for abnormal events, and allow users to set up separate profiles, and switch profiles based on day/night or holiday schedules.
6. The camera shall offer three levels of password protection, support 802.1x authentications using a RADIUS (Remote Authentication Dial In User Service) server, store a SSL certificate for use with HTTPS, and be capable of being independently AES encrypted with 128-bit keys.
7. The camera shall support iSCSI devices to allow video stream to be recorded directly to an iSCSI RAID array, support iSCSI storage targets to enable the camera to function as a conventional DVR, have a microSD card slot that uses standard; off-the-shelf microSD (SDHC and SDXC) cards for local storage (up to 2 TB), and the local storage feature shall be capable of storage for Automatic Network Replenishment (ANR).
8. The camera shall have an integrated omni-directional microphone, offer two-way, full duplex audio communication, and offer G.711, AAC and L16 audio compression (live and recording).
9. The camera shall provide a full circle image as well as two distortion-free channels with their own streams. One of these channels is an E-PTZ channel which is always available. Viewing options for the second channel on the 180 degree version shall be Panorama (3648 X 1080) and E-PTZ (1920 X 1080) view and on the 360 degree version shall include double panorama (2560 X 1440), E-PTZ (1280 X 720), North/South/East/West (5120 X 720) and Corridor view 2640 X 960)
10. The camera shall be ONVIF Profile S compliant to allow integration with third-party client-side dewarping software.
11. Operating Temperature: -20°C to +40°C (-4°F to 104°F)

F. 1080P PTZ CAMERAS

1. General Characteristics:
 - a. The 1080P IP PTZ camera shall be a full-featured HD PTZ unit designed for discrete video surveillance applications in indoor and outdoor environments and shall have a high performance 1/2.8-in. progressive scan day/night CMOS sensor with up to 1920 x 1080 (2.1MP) resolution, autofocus lens with 30X optical zoom and 12X digital zoom, Wide Dynamic Range of 120 dB for clear images in extreme high-contrast environments, and direct network connection using H.264 and M-JPEG compression and bandwidth throttling to efficiently manage bandwidth and storage requirements while delivering outstanding image quality.
 - b. The day/night HD IP PTZ camera shall also offer 256 user-defined pre-position settings with 20-character titles, bi-directional audio, Intelligent Tracking that controls the pan, tilt, and zoom movements of the camera to continuously follow an object or individual, an SD card slot that uses a standard; off-the-shelf SD (Secure Digital), SDHC (Standard Digital High Capacity) or a SDXC (Secure Digital eXtended Capacity) card for local storage (up to 2 TB), and capable of capturing and storing images using H.264 compression at up to 1080P resolution.
 - c. Redundant power options:
 - 1) Outdoor Pendant Models using the Heater:
 - a) 24 VAC
 - b) High PoE (using the Bosch NPD-6001A Midspan)

ALTERATIONS AND ADDITIONS
TO THE CALHOUN COUNTY JAIL
CALHOUN COUNTY, ALABAMA

- 2) Indoor Pendant Models (not using the heater) and In-ceiling Models:
 - a) 24 VAC
 - b) PoE+ (IEEE 802.3at, class 4) or High PoE (using the Bosch NPD-6001A Midspan)
- d. Imaging:
 - 1) The HD PTZ camera shall offer a 1/2.8-inch type Exmor CMOS imager with an effective number of pixels of 1944 x 1224 (2.13 megapixels) and a 16:9 aspect ratio.
 - 2) The HD PTZ camera shall offer a 30x optical zoom lens (4.3 to 129 mm).
 - 3) The HD PTZ camera shall have 2.3° to 65° field of view.
 - 4) The HD PTZ camera shall produce a color image with a minimum scene illumination of 0.0077 lux and a monochrome image, when in the night mode, with a minimum illumination of 0.0008 lux at 30 IRE.
 - 5) The HD PTZ camera shall offer automatic focus and iris control with manual override.
 - 6) The HD PTZ camera shall offer a Sodium Vapor White Balance mode that automatically compensate for light from a sodium vapor lamp to restore objects to their true color.
 - 7) The HD PTZ camera shall offer an anti-fog image feature that assists the camera in registering a usable image through the heaviest fog.
- e. PTZ Features – Speeds:
 - 1) Turbo Mode (manual control):
 - a) Pan: 0.1°/s to 400°/s
 - b) Tilt: 0.1°/s to 300°/s
 - 2) Normal Mode:
 - a) Pan: 0.1°/s to 120°/s
 - b) Tilt: 0.1°/s to 120°/s
 - 3) Preposition speeds:
 - a) Pan: 0.1°/s to 400°/s
 - b) Tilt: 0.1°/s to 300°/s
 - 4) Pan range: 360° continuous.
 - 5) Tilt angle:
 - a) 18° above the horizon for pendant housings.
 - b) 1° above the horizon for in-ceiling housings.
 - 6) Tour modes:
 - a) One (1) preset tour capable of 256 sequential pre-positions and a configurable dwell time between positions.
 - b) Two (2) separate tours of an operator's keyboard movements consisting of pan, tilt and zoom activities. The recorded tours can be continuously played back.
 - c) One (1) 360° AutoPan mode.
 - d) One (1) AutoPan mode between limits.
- f. Network
 - 1) Video Compression: H.264 (ISO/IEC 14496-10), M-JPEG, JPEG
 - 2) GOP Structure: IP, IBP, IBBP
 - 3) Data Rate: 9.6 kbps to 6 Mbps (per stream)
 - 4) Overall IP delay: 240 ms
 - 5) Resolution:
 - a) 1080p HD: 1920 x 1080
 - b) 720p HD: 1280 x 720
 - c) 432p SD: 768 x 432
 - d) 288p SD: 512 x 288
 - e) 144p SD: 256 x 144

ALTERATIONS AND ADDITIONS
TO THE CALHOUN COUNTY JAIL
CALHOUN COUNTY, ALABAMA

- 6) Ethernet: 10-Base T/100 Base-TX, auto-sensing, half/full duplex, RJ45
 - 7) Protocols: IPv4, IPv6, UDP, TCP, HTTP, HTTPS, RTP/RTCP, IGMP V2/V3, ICMP, ICMPv6, RTSP, FTP, Telnet, ARP, DHCP, SNMP, SNMP(V1, MIB II), 802.1x, DNS, DNSv6, DDNS (DynDNS.org, selfHOST.de, no-ip.com), SMTP, iSCSI, UPnP (SSDP), DiffServ (QoS), LLDP, SOAP, Dropbox, CHAP, digest authentication
 - 8). Advanced Networking: IPv6, QoS
 - 9) Audio - Standard:
 - a) G.711, 8 kHz sampling rate,
 - b) L16, 16 kHz sampling rate
 - c) AAC, 16 kHz sampling rate
 - 10) Signal-to-Noise Ratio: >50 dB
 - 11) Audio Streaming: Bidirectional (full-duplex)
- g. Environmental
- 1) Design Rating:
 - a) In-ceiling: IP54, Plenum rated
 - b) Pendant: IP66
 - c) Pendant: NEMA 4X for:
 - 1) Access to Hazardous parts
 - 2) Ingress of solid foreign objects (falling dirt, circulating dust, settling dust)
 - 3) Ingress of water (dripping and light splashing, hosedown and splashing)
 - 4) Corrosive agents
 - 2) Operating Temperature:
 - a) In-ceiling: -10°C to +40°C (14°F to 104°F)
 - b) Outdoor Pendant: -40°C to +55°C (-40°F to 131°F)
 - c) Indoor Pendant: -10°C to +55°C (14°F to 131°F), without heater connected in power supply box for indoor applications
 - 3) Humidity:
 - a) In-ceiling: 0% to 90% relative, non-condensing
 - b) Indoor Pendant/Outdoor Pendant with Heater: 0% to 100% relative, non-condensing
 - 4) Construction
 - a) Bubble Size: 153.1 mm (6.03 in.)
 - b) Housing
 - 1) In-ceiling: Magnesium
 - 2) Pendant: Cast aluminum
 - c) Bubble:
 - 1) In-ceiling: High-resolution acrylic, rugged polycarbonate, or rugged high-resolution acrylic
 - 2) Pendant: High-resolution acrylic or rugged polycarbonate
 - 5) Standard Color: White (RAL9003)
 - 6) Standard Finish: Powder coated, sand finish

G. HD VIDEO DECODER

1. The HD video decoder specified shall be capable of functioning on data networks, such as Ethernet LANs and over the Internet and shall be capable of decoding high definition and standard definition streams using H.264 or MPEG-4 compression technology at up to 60 ips.

ALTERATIONS AND ADDITIONS
TO THE CALHOUN COUNTY JAIL
CALHOUN COUNTY, ALABAMA

2. The HD video decoder shall be capable of decoding four (4) 4KP30 streams at 32Mbps or seven (7) 1080P30 streams at 10 Mbps or eight (8) H.264 SD streams with up to 2.5Mbps each.
3. The HD decoder specified shall be provided by the manufacturer complete with configuration cables, Installation and Operations Manuals, and safety instructions.
4. System Specifications
 - a. The HD decoder shall be based on the Intel fifth generation Core i3 CPU
 - b. The HD decoder shall offer a Gigabyte Ethernet port.
 - c. The HD decoder shall run a tailored Microsoft Windows 8.1 Embedded operating system.
5. Monitor Support
 - a. The HD video decoder shall be capable of driving two (2) 4K UHD display devices via mini DisplayPorts
 - b. The HD decoder shall be capable of displaying four (4) high definition streams in a quad-view display.
 - c. The HD decoder shall be capable of switching screen layouts independently based on the controlling video management system.
6. Video:
 - a. Video Outputs: 2 simultaneous
 - b. Connectors: Mini DisplayPort 1.2
 - c. Video Compression Standards: H.264 (ISO/IEC 14496-10)
 - d. MPEG-4
7. Data Rates:
 - a) MP: Up to 32 Mbps
 - b) 4K UHD: Up to 32 Mbps
 - c) HD: Up to 20 Mbps
 - d) SD: Up to 6 Mbps per stream
8. GOP structure: I, IP, IBBP
9. Monitor Resolutions:
 - a) DP: 3840 x 2160 maximum (UHD) at 60 Hz
10. Network
 - a. Ethernet: 10/100/1000 Base-T, auto-sensing, half/full duplex, RJ45
 - b. Protocols: RTP, Telnet, UPD, TCP, IP, HTTP, HTTPS, DHCP, IGMP V2/V3, ICMP, ARP, SNTP, SNMP (V1, MIB-II)
 - c. Encryption: TLS 1.0, SSL, AES (optional)

H. CCTV MONITORS

1. The 32" inch color monitors shall provide a high resolution picture; high quality; thin film transfer LCD panel; front panel controls; built-in speaker; connections for video and audio input/output, including separate Y-C connectors for S-VHS input; 2 DVI-I, 1 HDMI, automatic color switching system for NTSC; and a connection for a personal computer.
2. The color monitor shall meet or exceed the following specifications:
 - a. The monitor shall provide a thin film transfer LCD flat panel with a maximum depth of 2.5 inches (6.4 cm).
 - b. The monitor shall provide an on-screen display for setup and adjustment of the monitor viewing parameters.
 - c. The monitor shall meet NTSC standards.
 - d. The monitor shall provide PC input with a 15-pin connector.
 - e. The monitor shall provide a minimum of 500 TV lines of resolution in composite video mode.
 - f. The monitor shall provide digital resolution of 1920 X 1080 pixels.

ALTERATIONS AND ADDITIONS
TO THE CALHOUN COUNTY JAIL
CALHOUN COUNTY, ALABAMA

- g. The monitor shall operate in a range of 90 to 260 VAC, 60 Hz or 12 VDC and shall consume a maximum of 30 watts.
- h. The monitor shall provide an automatic color switching system between NTSC formats.
- i. The monitor shall accept 1.0 V p-p composite video and provide 75 ohms of input/output impedance.
- j. The monitor shall provide a base for placing the unit on a flat surface.
- k. The monitor shall provide tint, color, brightness, contrast, volume, and power on/off controls on the front panel.
- l. The monitor shall provide 16.7 million colors, a contrast ratio of 300:1, and brightness of 200 cd/m².
- m. The monitor shall provide an RCA connector for video input/output, an S-VHS 4-pin mini-DIN connector, a 15-pin PC input connector, and RCA connectors for audio input/output. The monitor shall provide a channel selection button on the front.
- n. The monitor shall have a black plastic cabinet with a black matte texture coat finish.
- o. The monitor shall have an operating temperature range of 32° to 122°F (0° to 50° C) and an operating humidity range of 20% to 85% relative, non-condensing.

I. VIDEO MANAGEMENT SYSTEM

1. General Characteristics:

- a. The IP Video Storage Appliance shall be a RAID-5 or RAID-6 protected, all-in-one recording, viewing and management solution for network surveillance systems of up to 128 channels, come with a license for connecting 32 concurrent recordable cameras plus 8 sessions for replay, offer an optional license for 32/64 additional concurrent recordable cameras.
- b. The IP Video Storage Appliance shall be a pre-configured and pre-installed video management solution with 12TB (4 X 3), 16TB (4X4), 24TB (8 x 3), 32TB (16X3) or 64TB (16X4) of gross storage capacity, and a bandwidth of 550 Mbit/s.
- c. The IP Video Storage Appliance shall offer a dual port Gigabit Ethernet network interface, 4 GB system memory and an Intel Xeon Quad Core Processor, remote monitoring via a desktop application or a Web browser.

2. Processor

- a. The IP Video Storage Appliance shall contain an Intel Xeon Quad Core 3.5 GHz, 8M cache, 95 W processor.
- b. The IP Video Storage Appliance processor shall contain one (1) socket.
- c. The IP Video Storage Appliance processor shall feature a 1 x 8 MB Level 2 cache memory.
- d. The IP Video Storage Appliance processor shall include ECC Unbuffered memory protection.
- e. The IP Video Storage Appliance processor shall contain a 1600 MHz maximum front side Bus.

3. Memory

- a. The IP Video Storage Array shall have 8 GB, DDR3-1666 ECC UNB (1 x 8 GB) of memory installed.

4. Storage

- a. The IP Video Storage Appliance shall contain eight (8) or sixteen (16) 3.5 in. SATA storage trays.
- b. The IP Video Storage Appliance shall have 8 or 16, 3 or 4 TB SATA-3 (7,200 RPM, 64 M 3.5 in.) hard drives installed.
- c. The IP Video Storage Appliance shall offer a 3108-based SAS3 RAID card.
- d. The IP Video Storage Appliance shall include an AMD FirePro W4100 graphics card with 4 x Mini Display Port
- e. The IP Video Storage Appliance shall include a Creative Sound Blaster PCI sound card.
- f. The IP Video Storage Appliance shall include 2 X 120 GB SSD RAID-1 OS hard drives.

ALTERATIONS AND ADDITIONS
TO THE CALHOUN COUNTY JAIL
CALHOUN COUNTY, ALABAMA

5. Functions
 - a. The IP Video Storage Appliance shall feature a single-socket system, server-class motherboard.
 - b. The IP Video Storage Appliance shall offer an energy-efficient hot-swap redundant power supply.
 - c. The IP Video Storage Appliance shall offer hot-swap SATA-II hard drives providing up to 64 TB of gross storage capacity.
 - d. The IP Video Storage Appliance shall come pre-installed and pre-configured with all necessary software.
 - e. The IP Video Storage Appliance shall utilize Microsoft Windows Server 2012 R2.
6. Management
 - a. The IP Video Storage Appliance shall provide a user interface for system configuration and unified appliance management.
 - b. The IP Video Storage Appliance shall offer the Microsoft System Center Suite built-in.
 - c. The IP Video Storage Appliance shall allow operators to use one central tool for configuration and operations management.
7. Monitoring
 - a. The IP Video Storage Appliance shall provide SNMP, Remote Desktop and HTTP monitoring support.
 - b. The IP Video Storage Appliance shall offer high-availability hardware, embedded design, and system wide monitoring.
8. Electrical:
 - a. Input Voltage: 120 VAC
 - 1) Actual Output Wattage from Power Supply: 413.9 W
 - 2) Efficiency of Power Supply: 92%
 - 3) Total System Power Consumption: 449.9 W
 - 4) Total BTU/h: 1535.4
 - 5) Power Factor: .98
 - 6) System AC Input VA Requirement: 459 VA
9. Mechanical
 - a. Form Factor: 2U or 3U Rack Mount
 - b. Power Supply: 1200 W Platinum Level redundant
 - c. USB Ports: 4 USB 2.0; 2 in rear, 2 in front, 2 USB 3.0 ports rear
 - d. Network: Dual Intel® i210AT Gigabit LAN
 - e. Dimensions (H x W x D): 648 x 437 x 89 mm (25.5 x 17.2 x 3.5 in (2RU) or 5.2 in(3RU).)
 - f. Weight: 23.6 kg (52 lb) 2RU or 32.7 kg (72 lb) 3RU
10. Environmental:
 - a. Operating Temperature: +10°C to +35°C (+50°F to +95°F)
 - b. Operating Relative Humidity: 8 to 90%, non-condensing

J. VIDEO MANAGEMENT SYSTEM

1. The video management system is designed to work with Bosch CCTV and ONVIF compliant 3rd party products as part of a total video security management system to provide full virtual matrix switching and control capability. The video management system consists of the following software modules: management server, recording services, configuration client and operator clients. Video from other sites may be viewed from single or numerous workstations simultaneously at any time. Cameras, recorders, and viewing stations may be placed anywhere in the IP network.
2. The VMS shall support the following recording services:
 - a. Local Storage and Direct-to-iSCSI recording
 - b. Streaming Gateway

ALTERATIONS AND ADDITIONS
TO THE CALHOUN COUNTY JAIL
CALHOUN COUNTY, ALABAMA

c. DVRs

3. The management server and the Bosch Video Recording Manager shall run as services on Windows Server 2012R2 loaded on the appliance.
4. The configuration client software shall run as an application on Windows Server 2012R2 loaded on the appliance.
5. The VMS shall support ONVIF compliant cameras. It shall be possible to access live streams and to control PTZ functionality.
6. It shall be possible to record Onvif compliant cameras. For recording only, 3rd party cameras that support JPEG or RTSP shall be supported.
7. The VMS shall provide a transcoding service for supporting iPad and iPhone devices as well as html5 based web clients as mobile video clients.
8. Mobile video clients shall be able to access live and recording data of all cameras in the video management system. It shall be possible to view up to 4 video streams at once on a web client or iPad and mix live and playback streams. The mobile video clients shall furthermore provide an option for the user to zoom in as well as to opt between high resolution and smooth motion (higher rate of frames per second). It shall be possible to access the video management system from mobile video clients with the user accounts in the video management system.
9. The VMS shall provide a documented Software Development Kit (SDK) to allow integration to and integration from third-party software.
10. The VMS specified shall be a centrally managed, scalable client/server based architecture that allows full virtual matrix switching and control systems.
11. The VMS shall be capable to be deployed in Local Area Networks (LAN) as well as in Wide Area Networks (WAN). For establishing remote connections across WAN, it shall be possible to setup a port mapping table within the configuration manager in order to map the public port to a private IP and port of the devices. The VMS shall provide a RRAS configuration tool to transfer the port mapping table to a RRAS Service.
12. The VMS shall allow a operator client to control and view live and playback streams of cameras allocated to the VRM, VSG and DVRs from a remote site (across WAN). This includes ONVIF cameras connected to the VSG.
13. The VMS shall provide the possibility to the operator to view transcoded video streams (live and playback) in order view high quality images, when the remote operator client accesses the camera via a low bandwidth connection. On selection, there shall be an indication in the image pane of the operator client to indicate, that the stream is being transcoded.
14. The VMS shall provide a built-in command script editor that allows customized command scripts to be written to control virtually all the system functions. Command scripts may be activated by system operators or automatically in response to alarms or system events. The built-in command script editor shall support C# and VB.NET.
15. The VMS shall provide up to 10 different and independent programmable recording schedules. The schedules may be programmed to provide different record frames rates for day, night, and weekend periods as well as special days. Advanced task schedules may also be programmed that could specify allowed logon times for user groups, when events may trigger alarms, and when data backups should occur.
16. The VMS shall allow the establishment of user groups and Enterprise user groups that have access rights to specific cameras, priority for pan/tilt/zoom control, rights for exporting video, and access rights to system event log files. Access to live, playback, audio, PTZ control, preset control, and auxiliary commands shall be programmable on an individual camera basis.
17. The VMS shall export video and audio data optionally in ASF format to a CD/DVD drive, a network drive, or a USB drive. The exported data in ASF format may be played back using

ALTERATIONS AND ADDITIONS
TO THE CALHOUN COUNTY JAIL
CALHOUN COUNTY, ALABAMA

standard software such as Windows Media Player. It shall also export video and audio data optionally in its native recording format to a CD/DVD drive, a network drive, or a direct attached drive. The exported data in native recording format shall include all associated metadata. Viewer software shall be included with the export. Once installed, the viewer software allows playback of the streams on any compatible Windows PC.

18. The VMS shall auto-discover encoder, decoder, VRM devices and DVRs. Device detection shall support devices in different subnets.
19. The VMS shall support continuous operation during management server down-times as live viewing, playback of recording and export of video data. The operator client shall indicate its connection status to the management server.

K. VIDEO RECORDING MANAGER (VRM)

1. The VRM shall be preloaded on the appliance specified in 1.20 above.
2. The VRM shall be configured from the VMS configuration client. It shall be possible to assign encoders and IP cameras to it.
3. The recording parameters shall be configured in the recording tables of the VMS configuration program. These settings will be replicated into the devices from the management server.
4. The VRM shall manage exclusively the Bosch encoders, Bosch IP-Cameras, Bosch Streaming Gateways, and the Bosch supported iSCSI storage systems. It shall offer system wide recording monitoring and management of iSCSI storage, video servers and cameras.
5. The VRM shall support the encoders and cameras to directly stream the data to the iSCSI storage. The VRM shall not be involved in the processing of the data.
6. The VRM shall manage all disk arrays in the system as a single virtual common pool of storage. It shall dynamically assign portions of that pool to the encoders and IP-Cameras.
7. The transfer rate of the data from the encoder or IP-Camera is limited by network speed and the iSCSI data throughput rate.
8. The VRM shall provide redundancy for storage provisioning and failover design for central recording management service.
9. The VRM shall be able to restore a lost recording database from data on the iSCSI storages.
10. The VRM shall provide flexible retrieval of recordings. It shall be able to determine on which iSCSI disk array data from each camera or encoder has been stored.
11. It shall be possible to secure the access to the VRM software with a password. This shall be done in the configuration client.
12. The VRM software shall provide status monitoring information as a web interface. The following information shall be provided:
 - a. Uptime of the VRM software
 - b. Bit rate information for the recorded data
 - c. Retention times per camera
 - d. Status on recording and storage
13. The video management system shall allow configuring if playback of recordings is streamed through the VRM or is streamed directly from the iSCSI storage.
14. The video management system shall support to retrieve the playback information, i.e. from which iSCSI storages to retrieve the video, audio and meta-data, either from the Video

ALTERATIONS AND ADDITIONS
TO THE CALHOUN COUNTY JAIL
CALHOUN COUNTY, ALABAMA

Recording Manager or directly from the IP encoder or camera. Playback information directly from the IP encoder or camera is limited in time and should be used while the VRM is not available to increase the reliability of the video management system.

L. SERVER

1. Provide as required for BVMS and VRM.
2. HP ProLiant DL380 Generation 9 (G9) Server with hot plug fans and power supplies, and RAID controller with RAID-1 operating system protection. One (1) state-of-the-art six-core Intel Xeon Processor E5-2620 (2.0 GHz, 6 core, 15 MB L3 cache, 95W, and 8 (2 X 4 GB PC3L-10600R (DDR3-1333) Registered DIMMs. 1 x Four Port Gigabit Server Adapter.
3. Provide a 3–year standard warranty.
4. The server shall come in a 2U, 19-inch rack mount version with a quick deploy rail system, including sliding universal rails. The rack mount version allows access to all system components for easy in-rack serviceability.

M. ISCSI STORAGE DEVICES

1. General Characteristics:
 - a. The IP Video Storage System shall be an embedded, all-in-one IP Video Storage subsystem that provides “plug-and-play” iSCSI-based recording and management, pre-configured and pre-installed iSCSI disk array, 2U rack mount chassis with eight (8) or sixteen (16) hot swappable, 3 Gbps SATA-II hard disk drives with RAID-5/RAID-6 protection.
 - b. The IP Video Storage System shall be a pre-configured and pre-installed video management solution with 12TB (4 X 3), 16TB (4X4), 24TB (8 x 3), 32TB (16X3 or 8X4) 48TB (8X6), 64TB (8X8 or 16X4), 96TB (16X6) or 128 (16X8) of gross storage capacity, and a bandwidth of 550 Mbit/s.
 - c. The IP Video Storage System shall offer a dual port Gigabit Ethernet network interface, 4 GB system memory and an Intel Xeon Quad Core Processor, remote monitoring via a desktop application or a Web browser.
2. Processor
 - a. The IP Video Storage Appliance shall contain an Intel Xeon Quad Core 3.5 GHz, 8 M cache, 95 W processor.
 - b. The IP Video Storage Appliance processor shall contain one (1) socket.
 - c. The IP Video Storage Appliance processor shall feature a 1 x 8 MB Level 2 cache memory.
 - d. The IP Video Storage Appliance processor shall include ECC Unbuffered memory protection.
 - e. The IP Video Storage Appliance processor shall contain a 1600 MHz maximum front side Bus.
3. Memory
 - a. The IP Video Storage Array shall have 8 GB, DDR3-1666 ECC UNB (1 x 8 GB) of memory installed.
4. Storage
 - a. The IP Video Storage Appliance shall contain eight (8) or sixteen (16) 3.5 in. SATA storage trays.

ALTERATIONS AND ADDITIONS
TO THE CALHOUN COUNTY JAIL
CALHOUN COUNTY, ALABAMA

- b. The IP Video Storage Appliance shall have 8 or 16, 3, 4 6 or 8 TB SATA-3 (7,200 RPM, 64 M 3.5 in.) hard drives installed.
 - c. The IP Video Storage Appliance shall offer a 3108-based SAS3 RAID card.
 - d. The IP Video Storage Appliance shall include an AMD FirePro W4100 graphics card with 4 x Mini Display Port
 - e. The IP Video Storage Appliance shall include a Creative Sound Blaster PCI sound card.
 - f. The IP Video Storage Appliance shall include 2 X 120 GB SSD RAID-1 OS hard drives
5. Functions
- a. The IP Video Storage Appliance shall feature a single-socket system, sever-class motherboard.
 - b. The IP Video Storage Appliance shall offer an energy-efficient hot-swap redundant power supply.
 - c. The IP Video Storage Appliance shall offer hot-swap SATA-II hard drives providing up to 64 TB of gross storage capacity.
 - d. The IP Video Storage Appliance shall come pre-installed and pre-configured with all necessary software.
 - e. The IP Video Storage Appliance shall utilize Microsoft Windows Server 2012 R2.
6. Management
- a. The IP Video Storage Appliance shall provide a user interface for system configuration and unified appliance management.
 - b. The IP Video Storage Appliance shall offer the Microsoft System Center Suite built-in.
 - c. The IP Video Storage Appliance shall allow operators to use one central tool for configuration and operations management.
7. Monitoring
- a. The IP Video Storage Appliance shall provide SNMP, Remote Desktop and HTTP monitoring support.
 - b. The IP Video Storage Appliance shall offer high-availability hardware, embedded design, and system wide monitoring.
8. Electrical:
- a. Input Voltage: 120 VAC
 - b. Actual Output Wattage from Power Supply: 413.9 W
 - c. Efficiency of Power Supply: 92%
 - c. Total System Power Consumption: 449.9 W
 - e. Total BTU/h: 1535.4
 - f. Power Factor: .98
 - g. System AC Input VA Requirement: 459 VA
9. Mechanical
- a. Form Factor: 2U or 3U Rack Mount
 - b. Power Supply: 1200 W Platinum Level redundant
 - c. USB Ports: 4 USB 2.0; 2 in rear, 2 in front, 2 USB 3.0 ports rear

ALTERATIONS AND ADDITIONS
TO THE CALHOUN COUNTY JAIL
CALHOUN COUNTY, ALABAMA

- d. Network: Dual Intel® i210AT Gigabit LAN
 - e. Dimensions (H x W x D): 648 x 437 x 89 mm (25.5 x 17.2 x 3.5 in (2RU) or 5.2 in(3RU).)
 - f. Weight: 23.6 kg (52 lb) 2RU or 32.7 kg (72 lb) 3RU
10. Environmental:
- a. Operating Temperature: +10°C to +35°C (+50°F to +95°F)
 - b. Operating Relative Humidity: 8 to 90%, non-condensing

N. HD VIDEO DECODER

1. The HD video decoder specified shall be capable of functioning on data networks, such as Ethernet LANs and over the Internet and shall be capable of decoding high definition and standard definition streams using H.264 or MPEG-4 compression technology at up to 60 ips.
2. The HD video decoder shall be capable of decoding four (4) 4KP30 streams at 32Mbps or seven (7) 1080P30 streams at 10 Mbps or eight (8) H.264 SD streams with up to 2.5Mbps each.
3. The HD decoder specified shall be provided by the manufacturer complete with configuration cables, Installation and Operations Manuals, and safety instructions.
4. System Specifications
 - a. The HD decoder shall be based on the Intel fifth generation Core i3 CPU
 - b. The HD decoder shall offer a Gigabyte Ethernet port.
 - c. The HD decoder shall run a tailored Microsoft Windows 8.1 Embedded operating system.
5. Monitor Support
 - a. The HD video decoder shall be capable of driving two (2) 4K UHD display devices via mini DisplayPorts
 - b. The HD decoder shall be capable of displaying four (4) high definition streams in a quad-view display.
 - c. The HD decoder shall be capable of switching screen layouts independently based on the controlling video management system.
6. Video:
 - a. Video Outputs: 2 simultaneous
 - b. Connectors: Mini DisplayPort 1.2
 - c. Video Compression Standards: H.264 (ISO/IEC 14496-10)
 - d. MPEG-4
7. Data Rates:
 - a) MP: Up to 32 Mbps
 - b) 4K UHD: Up to 32 Mbps
 - c) HD: Up to 20 Mbps
 - d) SD: Up to 6 Mbps per stream
8. GOP structure: I, IP, IBBP
9. Monitor Resolutions:
 - a) DP: 3840 x 2160 maximum (UHD) at 60 Hz
10. Network
 - a. Ethernet: 10/100/1000 Base-T, auto-sensing, half/full duplex, RJ45
 - b. Protocols: RTP, Telnet, UPD, TCP, IP, HTTP, HTTPS, DHCP, IGMP V2/V3, ICMP, ARP, SNTP, SNMP (V1, MIB-II)
 - c. Encryption: TLS 1.0, SSL, AES (optional)

ALTERATIONS AND ADDITIONS
TO THE CALHOUN COUNTY JAIL
CALHOUN COUNTY, ALABAMA

O. POWER SUPPLIES

1. Provide centralized power supplies with capacity adequate for the cameras, controls and all accessories of each location as scheduled. Power supplies shall be 120VAC input and 24VAC output. Each camera shall be individually protected by a circuit breaker.

P. SURGE PROTECTION

1. All cameras shall have surge protection on their video terminations to guard against induced transients. Exterior PTZ cameras shall surge protection devices for both video and data. All exterior cameras shall also have surge protection devices on the 24 VAC power.

2.0 EXAMINATION

- A. Verify that surfaces and areas are ready to receive work.
- B. Verify field measurements are as shown on Drawings and as instructed by manufacturer.
- C. Verify that required utilities are available, in proper location, and ready for use.

PART 3 – EXECUTION

3.0 INSTALLATION

- A. Field testing and inspection will be performed under the provisions of Section 28 40 00
- B. Replace equipment, components, & wiring as required to achieve a fully functional system.

3.1 DEMONSTRATION, TRAINING AND ACCEPTANCE

- A. Demonstration, training, and acceptance shall be as described in Section 28 40 00.

3.2 WARRANTY

- A. All parts provided shall include 3 year manufacturer's warranty with advanced replacements available during the entire warranty period.

3.3 SPARES

- A. See Section 28 40 00 Security Control system, - SPARE PARTS

END OF SECTION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 28: ELECTRONIC SAFETY AND SECURITY
Section 28 31 11 - Fire Alarm

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes additions and alterations to the existing fire alarm systems with detectors, controls, and devices.

1.3 DEFINITIONS

- A. FACP: Fire alarm control panel.
- B. LED: Light-emitting diode.
- C. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

1.4 SYSTEM DESCRIPTION

- A. General: Additional fire alarm devices being added to the existing zoned or addressable system.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
 - 1. Wiring Diagrams: Detail wiring and differentiate between manufacturer-installed and field-installed wiring. Include diagrams for equipment and for system with all terminals and interconnections identified.
 - 2. Battery.
 - 3. Floor Plans: Indicate final outlet locations and routings of raceway connections.
- C. Product Certificates: Signed by manufacturers of system components certifying that products furnished comply with requirements.
- D. Installer Certificates: Signed by manufacturer certifying that installers comply with requirements.
- E. Submissions to Authorities Having Jurisdiction: In addition to distribution requirements for Submittals specified in Division 1 Section "Submittals," make an identical submission to au-

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

thorities having jurisdiction. Include copies of annotated Contract Drawings as needed to depict component locations to facilitate review. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Architect for review.

- F. Certificate of Completion: Comply with NFPA 72.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is an authorized representative of the FACP manufacturer for both installation and maintenance of units required for this Project.
- B. Manufacturer Qualifications: A firm experienced in manufacturing systems similar to those indicated for this Project and with a record of successful in-service performance.
- C. Source Limitations: Obtain fire alarm system components through one source from a single manufacturer.
- D. Compliance with Local Requirements: Comply with applicable building code, local ordinances and regulations, and requirements of authorities having jurisdiction.
- E. Comply with NFPA 72.
- F. The State of Alabama Certified Fire Alarm Act requires that every business who installs fire alarm systems in commercial occupancies must be licensed as a Certified Fire Alarm Contractor. The contractor must have a NICET Level III Technician in a position of responsibility, and the license will be issued in the name of the certificate holder and the contractor. The Certified Fire Alarm Act also requires that technicians working for the Certified Contractor must hold a current NICET Level II, or equivalent, certification. Each fire alarm contractor wishing to bid on the fire alarm work shall provide proof with their bid that he/she meets the certification requirements of the Act and holds a permit issued by the State Fire Marshal.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Potter Electric Signal Company (Existing FACP is Potter PFC-4064).

2.2 FUNCTIONAL DESCRIPTION OF SYSTEM

- A. Control of System: By the FACP.
- B. System Supervision: Automatically detect and report open circuits, shorts, and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
- C. Priority of Signals: Automatic alarm response functions resulting from an alarm signal from one zone or device are not altered by subsequent alarm, supervisory, or trouble signals. An alarm signal is the highest priority. Supervisory and trouble signals have second- and third-level priority. Higher-priority signals take precedence over signals of lower priority, even

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

when the lower-priority condition occurs first. Annunciate and display all alarm, supervisory, and trouble signals regardless of priority or order received.

- D. Noninterference: A signal on one zone shall not prevent the receipt of signals from other zones.
- E. System Reset: All zones are manually resettable from the FACP after initiating devices are restored to normal.
- F. Transmission to Remote Alarm Receiving Station: Automatically route alarm, supervisory, and trouble signals to a remote alarm station by means of a digital alarm communicator transmitter and telephone lines.
- G. System Alarm Capability during Circuit Fault Conditions: System wiring and circuit arrangement prevent alarm capability reduction when a single ground occurs in an initiating device circuit, signal line circuit, or notification-appliance circuit.
- H. Loss of primary power at the FACP initiates a trouble signal at the FACP and the annunciator. An emergency power light is illuminated at both locations when the system is operating on the secondary power supply.
- I. Basic Alarm Performance Requirements: Unless otherwise indicated, operation of a manual station, automatic alarm operation of a smoke or flame or heat detector, or operation of a sprinkler flow device initiates the following:
 - 1. Notification-appliance operation.
 - 2. Identification at the FACP and the remote annunciator of the device originating the alarm.
 - 3. Transmission of an alarm signal to the remote alarm receiving station.
 - 4. Recording of the event in the system memory.
- J. Alarm Silencing, System Reset and Indication: Controlled by switches in the FACP and the remote annunciator.
 - 1. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
 - 2. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
 - 3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.
- K. Removal of an alarm-initiating device or a notification appliance initiates the following:
 - 1. A "trouble" signal indication at the FACP and the annunciator for the device or zone involved.
 - 2. Transmission of trouble signal to remote alarm receiving station.
- L. FACP Alphanumeric Display: Plain-English-language descriptions of alarm, supervisory, and trouble events; and addresses and locations of alarm-initiating or supervisory devices originating the report. Display monitoring actions, system and component status, system commands, programming information, and data from the system's historical memory.
- M. Transient Voltage Surge Suppression: Provide transient voltage surge suppression at the FACP for the incoming power supply and the outgoing connection to the remote station receiving unit.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2.3 MANUAL PULL STATIONS

- A. Description: Fabricated of metal or plastic, and finished in red with molded, raised-letter operating instructions of contrasting color.
1. Double-action mechanism requires two actions, such as a push and a pull, to initiate an alarm.
 2. Station Reset: Key or wrench operated; double pole, double throw; switch rated for the voltage and current at which it operates.
 3. Integral Addressable Module: Arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.

2.4 SMOKE DETECTORS

- A. General: Include the following features:
1. Operating Voltage: 24-V dc, nominal.
 2. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 3. Plug-in Arrangement: Detector and associated electronic components are mounted in a module that connects in a tamper-resistant manner to a fixed base with a twist-locking plug connection. Terminals in the fixed base accept building wiring.
 4. Integral Visual-Indicating Light: LED type. Indicates detector has operated.
 5. Sensitivity: Can be tested and adjusted in-place after installation.
 6. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
- B. Photoelectric Smoke Detectors: Include the following features:
1. Sensor: LED or infrared light source with matching silicon-cell receiver.
 2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.
- C. Duct Smoke Detector: Photoelectric type.
1. Sampling Tube: Design and dimensions as recommended by the manufacturer for the specific duct size, air velocity, and installation conditions where applied.
 2. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.5 OTHER DETECTORS

- A. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or rate of rise of temperature that exceeds 15 deg F (8.3 deg C) per minute, unless otherwise indicated.
1. Mounting: Adapter plate for outlet box mounting.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

2.6 NOTIFICATION APPLIANCES

- A. Description: Equip for mounting as indicated and have screw terminals for system connections.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.
 - B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Horns produce a sound-pressure level of 90 dB, measured 10 feet (3 m) from the horn.
 - C. Mini-horns: Piezo type, 24-V dc; with provision for housing the operating mechanism behind a grille.
 - D. Visible Alarm Devices: Xenon strobe lights listed under UL 1971 with clear or nominal white polycarbonate lens. Mount lens on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
 1. Rated Light Output: 75 candela.
 2. Strobe Leads: Factory connected to screw terminals.
- 2.7 REMOTE DEVICE LOCATION-INDICATING LIGHTS AND IDENTIFICATION PLATES
- A. Description: LED indicating light near each smoke detector that may not be readily visible, and each sprinkler water-flow switch and valve-tamper switch. Light is connected to flash when the associated device is in an alarm or trouble mode. Lamp is flush mounted in a single gang wall plate. A red, laminated, phenolic-resin identification plate at the indicating light identifies, in engraved white letters, device initiating the signal and room where the smoke detector or valve is located. For water-flow switches, the identification plate also designates protected spaces downstream from the water-flow switch.
- 2.8 CENTRAL FACP
- A. Tie in to the existing FACP and add any expansion equipment or include FACP replacement if necessary to add the new devices to the existing system. Recertify the system once all modifications have been made.
- 2.9 ADDRESSABLE INTERFACE DEVICE
- A. Description: Microelectronic monitor module listed for use in providing a multiplex system address for listed fire and sprinkler alarm-initiating devices with normally open contacts.
 - B. Integral Relay: Capable of providing a direct signal to the elevator controller to initiate elevator recall or to a circuit-breaker shunt trip for power shutdown.
- 2.10 WIRE
- A. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
 1. Low-Voltage Circuits: No. 14 AWG, minimum.
 2. Line-Voltage Circuits: No. 12 AWG, minimum.
 - B. Power-Limited Circuits: NFPA 70, Types FPL, FPLR, or FPLP, as recommended by manufacturer.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Manual Pull Stations: Mount semiflush in recessed back boxes.
- B. Ceiling-Mounted Smoke Detectors: Not less than **4 inches (100 mm)** from a side wall to the near edge. For exposed solid-joint construction, mount detectors on the bottom of joists. On smooth ceilings, install not more than **30 feet (9 m)** apart in any direction.
- C. Wall-Mounted Smoke Detectors: At least **4 inches (100 mm)**, but not more than **12 inches (300 mm)**, below the ceiling.
- D. Smoke Detectors near Air Registers: Install no closer than **60 inches (1520 mm)**.
- E. Audible Alarm-Indicating Devices: Install not less than **6 inches (150 mm)** below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Combine audible and visible alarms at the same location into a single unit.
- F. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least **6 inches (150 mm)** below the ceiling.
- G. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.2 WIRING INSTALLATION

- A. Wiring Method: Install wiring in EMT or RGS as noted in Section 26 0533.
- B. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by the manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- C. Cable Taps: Use numbered terminal strips in junction, pull and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- D. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- E. Wiring to Remote Alarm Transmitting Device: **1-inch (25-mm)** conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.3 IDENTIFICATION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. Identify system components, wiring, cabling, and terminals according to Division 26 Section "Basic Electrical Materials and Methods."
- B. Install instructions frame in a location visible from the FACP.
- C. Paint power-supply disconnect switch red and label "FIRE ALARM."

3.4 GROUNDING

- A. Ground cable shields and equipment according to system manufacturer's written instructions to eliminate shock hazard and to minimize, to the greatest extent possible, ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- B. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding.
- C. Ground equipment and conductor and cable shields. For audio circuits, minimize, to the greatest extent possible, ground loops, common-mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and connections and to supervise pretesting, testing, and adjustment of the system. Report results in writing.
- B. Pretesting: After installation, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the compliance of the system with requirements of Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones, and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.
- C. Report of Pretesting: After pretesting is complete, provide a letter certifying the installation is complete and fully operable, including the names and titles of witnesses to preliminary tests.
- D. Final Test Notice: Provide a minimum of 10 days' notice in writing when the system is ready for final acceptance testing.
- E. Minimum System Tests: Test the system according to procedures outlined in NFPA 72. Minimum required tests are as follows:
 - 1. Verify the absence of unwanted voltages between circuit conductors and ground.
 - 2. Test all conductors for short circuits using an insulation-testing device.
 - 3. With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter. Record the circuit resistance of each circuit on record drawings.
 - 4. Verify that the control unit is in the normal condition as detailed in the manufacturer's operation and maintenance manual.
 - 5. Test initiating and indicating circuits for proper signal transmission under open circuit conditions. One connection each should be opened at not less than 10 percent of initiating and indicating devices. Observe proper signal transmission according to class of wiring used.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

6. Test each initiating and indicating device for alarm operation and proper response at the control unit. Test smoke detectors with actual products of combustion.
 7. Test the system for all specified functions according to the approved operation and maintenance manual. Systematically initiate specified functional performance items at each station, including making all possible alarm and monitoring initiations and using all communications options. For each item, observe related performance at all devices required to be affected by the item under all system sequences. Observe indicating lights, displays, signal tones, and annunciator indications.
 8. Test Both Primary and Secondary Power: Verify by test that the secondary power system is capable of operating the system for the period and in the manner specified.
- F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets Specifications and complies with applicable standards.
- G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log on the satisfactory completion of tests. The contractor shall provide a "Record of Completion" to the Building Commission inspector at final inspection.
- H. Tag all equipment, stations, and other components at which tests have been satisfactorily completed.
- 3.6 CLEANING AND ADJUSTING
- A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and marred finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.
- 3.7 ON-SITE ASSISTANCE
- A. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels, controls, and sensitivities to suit actual occupied conditions.

END OF SECTION 28 31 11

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 28 SECURITY ELECTRONICS
Section 28 40 00 – Security Electronics System

PART 1 – GENERAL

1.1 DESCRIPTION

- A. General: Project Overview: The purpose of this project is to form a new facility-wide, completely integrated PLC based security solution for all new components and completely interfaced with existing system and all existing termination devices. See Summary of Work. This entire system shall be purchased, engineered and programmed by a single Division 28 Electronic Security Contractor (ESC).
1. Furnish all labor, materials, tools, equipment, and services for all new and existing electronic systems work as indicated, in accord with provisions of the Contract Documents.
 2. Completely coordinate with work of all other trades.
 3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation whether new or existing to be modified.
 4. Coordinate all Div. 28 conduit, backboxes, pull boxes and wiring requirements with the Div. 26 Electrical Contractor as required to make a complete and operational system. The Div. 28 contractor shall be responsible for any additional conduit or increases in conduit sizes other than the requirements indicated in the bid documents. The Div. 26 contractor shall furnish and install all Div. 28 standard conduit pull and back boxes. The Div. 28 contractor shall provide special back boxes to the Div. 26 contractor for installation.
 5. See Division 01 for General Requirements.
- B. Drawings use and interpretation:
1. Drawings are diagrammatic and indicate general arrangement of systems and equipment, except when specifically dimensioned or detailed.
 2. For exact locations of buildings elements, refer to dimensioned architectural/structural drawings.
 3. Field measurements take precedence over dimensioned drawings.
 4. Intention is to show size, capacity, approximate location, direction and general relationship of one work phase to another, but not exact detail or arrangement.
- C. Installation of all systems and equipment new and/or modified is subject to clarification as indicated in reviewed shop drawings and field coordination drawings.
- D. Dimensions indicated anywhere are limited dimensions.
- E. Do not use equipment exceeding dimensions indicated or equipment or arrangements that reduce required clearances or exceed specified maximum dimensions.
- F. Description of systems: Furnish and install all materials to provide functioning new and existing systems in compliance with performance requirements specified, and any modifications resulting from reviewed shop drawings and field coordinated drawings. Electronic security systems work as specified in this section includes:
1. Providing all equipment to provide a functional integrated system indicated in the contract documents to include new and existing components.
 2. Providing and installing required conduit, backboxes, special backboxes, wiring and terminations for field devices.
 3. Providing equipment cabinets and enclosures.
 4. Providing wiring for electronic systems.

1.02 RELATED WORK SPECIFIED ELSEWHERE

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. The work of this Section is related to the work of the following Sections:
1. Security Electronics: Touch Screen Control Stations
 2. Closed Circuit TV System
 3. Intercom & Paging System
 4. Inmate Call In System
 6. Metal Equipment Cabinets, Racks and Turrets
 7. Uninterruptible Power Supply System
 8. Security Management System
- B. Furnished and Installed by Division 26:
1. All conduit, pull boxes and back boxes required for a complete raceway system for the Div. 28 system including new and existing components where applicable.
 2. All 120 volt AC wiring and connections for power panels and/or terminal strips in Electronic panels, cabinets, enclosures or consoles.
 3. All 120 volt AC wiring, devices and connections for devices and equipment as Indicated on drawings.
 4. Control relay wiring to Division 28 terminal strips for control of 120VAC and/or 277VAC equipment including lighting, receptacles, shower control valves, etc. (Lighting relay cabinet and relays are to be furnished and installed by Div. 26 contractor). Low voltage control wiring to be furnished and installed by Division 27 contractor.
- C. Related work:
1. Division 8.
 - a. Commercial Door Hardware
 2. Division 11.
 - a. Detention Door Hardware and lock terminations
 3. Division 13
 - a. Precast Detention Modules
 4. Division 26
 - a. Raceway systems Products and Execution
 - b. Building wire Products and Execution
- 1.02 WARRANTY (See Division 01)
- A. See Division 01 for warranty requirements.
- B. Manufacturer's warranties that exceed beyond the requirements of Division 01 shall be Maintained and transferred to the Owner.
- C. See individual sections for additional warranty requirements.
- 1.03 QUALITY ASSURANCE
- A. Perform all work in accord with following codes and standards:
1. Federal, state and local codes, regulations and ordinances
 2. National Electric Code (NEC), latest edition
 3. Occupational Safety and Health Act (OSHA)
 4. All authorities having jurisdiction
 5. Factory Mutual System (FM) requirements
 6. EIA, Electronics Institute of America
 7. UL, Underwriters Laboratories
- B. Equipment Manufacturer:
1. Regularly engaged in the manufacture of products specified
 2. Manufacturer of products specified for a period of no less than five (5) years with satisfactory performance in similar applications.
- C. Installer:
1. Regularly engaged in installation of products specified

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Installer of products specified for a period of no less than five years with satisfactory performance.
- D. Systems specified in this Division shall be engineered, assembled, tested and installed under the direction of a pre-qualified electronic systems integrator. Electronic systems integrator shall meet the following minimum requirements.
1. Qualifications.
 - a. Successful completion of at least five(5) similar detention facilities which have been in successful operation for at least one (1) year.
 - b. Technical staff experienced and factory trained in systems specified.
 - c. The electronic systems integrator shall be bondable for an amount equal to 100% of his bid.
 2. Pre-qualified Electronic systems integrators.
 - a. Unique Security Inc., Montgomery, AL.
 - b. Stanley Integrator, Noblesville, IN
 - c. Cornerstone Detention, Huntsville, AL
 - d. Montgomery Technology Systems, LLC, Greenville, AL
 3. Electronic systems integrators must be pre-qualified to bid the project. Integrators not indicated but desiring approval shall comply with Division 01 requirements. Request for approval must be accompanied by system integration diagram based on the products specified herein for the project with proposed schedule and complete references of at least five (5) detention facilities of similar size and complexity in operation for at least one year.
- 1.04 Qualifications of the Electronic Systems Contractor (ESC):
- A. Other ESC firms shall request approval and shall submit the following qualification data to the architect in writing fourteen (14) days prior to bid date and, if approved, shall be acknowledged by Addendum prior to bid date. Verbal approval will not satisfy this requirement. All ESC's except those pre-approved, shall submit a completed AIA 305 form and all additional information herein requested or will not be allowed to bid. Grounds for disqualification shall exist if in the opinion of the architect, the information submitted is inaccurate or, does not satisfy the qualification requirements.
 - B. List at least five (5) correctional facility installations of security monitoring and control systems similar to the requirements of this project furnished and installed by this firm. The minimum period of operation for each of the five (5) facilities is one (1) year.
 - C. For each facility: List name and location of installation, date of occupancy by Owner, and Owner's representative to contact and telephone number. Construction Manager or General Contractor, and Architect.
 - D. Provide independently audited financial statement showing a minimum net worth of \$2,000,000 (consolidated/parent).
 - E. Provide statement indicating that bidding entity has not filed for bankruptcy protection within the past ten (10) years.
 - F. Submit a statement letter from the Surety Company stating that a 100% Payment and Performance Bond will be supplied if selected as the successful Electronic System subcontractor (ESS).
 - G. The intent of this specification is to insure the systems described in Division 28 are provided and installed by a technically experienced contractor and further that the Division 28 work is fully coordinated between the various systems by a single contractor who is technically qualified as described herein.
 - H. Where the contractor is a branch office or other division of a larger organization, the qualifications of the branch office or other division shall meet the requirements of Contract Documents. The

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

contractor, incorporated under the same name shall have successfully completed similar correctional construction projects both in scope and system types.

- a. The contractor shall provide a project superintendent for the overall management and supervision of the Division 28 work. The superintendent shall have the following Qualifications:
 1. Provide resume(s) of the superintendent including at least three (3) projects of the same size and complexity.
 2. Full time employee of the contractor
 3. Have a working knowledge of all systems installed under Division 26 and 28 and the interface therein.
- b. The Owner reserves the right to disqualify manufacturers, equipment suppliers, and Contractors who do not comply with the requirements of this paragraph of the Specifications.
- c. The Division 28 Contractor shall coordinate the underground conduit installation at the job site during the layout and installation of all underground conduit for all systems. All underground security conduits and pull boxes shall be furnished and installed by the Division 26 contractor. The Division 28 contractor shall provide Division 26 contractor with conduit layout drawings for all systems. The drawings shall include, but not limited to, number and size of conduits and exact stub up locations.
- d. Division 28: The General Contractor expressly warrants the Division 28 subcontractor for installation of Division 28 systems has demonstrated proficiency in the installation, start-up, and adjustment of such systems by the successful performance of work of the nature specified herein on at least three systems. The contractor further warrants that the aforesaid subcontractor has trained personnel, instruments, tools, and equipment to perform the installation, adjustment and training specified. The contractor also warrants that the aforesaid subcontractor, if any, has been in business under the present company name performing services of the nature specified herein for at least five years.
- e. Affidavits: As a condition to receiving a work order for the foresaid Division 28 subcontractors to perform the Division 28 work, the General contractor shall file with the architect within five days after signing the contract. Affidavits shall read exactly as follows.
- f. Filing of Affidavits: Failure to file the affidavits within ten days, time being of the essence, shall be deemed to be and shall be acknowledgement on the part of the contractor that there has been a breach of warranty pursuant to which breach an order of condemnation will be issued by the architect for breach of warranty and for breach of essential condition of the contract as to qualifications of the party or parties performing subcontracted work. The order of condemnation shall allow the Contractor ten days in which (a) to make good the breach of warranty and (b) to make good the deficiency as to the filing of a proper affidavit or affidavits.

AFFIDAVIT

"1. THIS IS TO CERTIFY that (insert name of Division 28 subcontractor) demonstrated proficiency in the installation, testing and training of Division 28 systems by the successful performance of work of the nature specified (in the bidding documents for the improvement referred to in paragraph 3 of this Affidavit) on at least three systems, each similar to this project, the foregoing installations having been the complete and undivided responsibility of the aforesaid Division 28 subcontractor.

List at least three showing name and address of each

(1) _____

(2) _____

(3) _____

"2. THE CERTIFICATIONS of the affiant are not mere declarations but are in consideration of and in fulfillment of express contractual requirements established in the bidding documents for the construction of the Judicial Complex for Pike County.

"3. THIS AFFIDAVIT applies to Judicial Complex for Pike County

This _____ day of _____, 20__.

NAME OF COMPANY:

By: _____

Title: _____

CERTIFICATE OF NOTARY PUBLIC

Sworn and subscribed before me, an officer authorized to administer oaths.

This _____ day of _____, 20__.

Notary Public

My commission expires on _____

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1.05 DRAWINGS:

- a. The drawings indicate the arrangement of new and existing electronic security equipment. Existing equipment is delineated to the highest extent on the attached original electrical documents. Review architectural drawings for door swings, cabinets, counters and built –in equipment; conditions indicated on architectural drawings shall govern for this work. Coordinate Installation of equipment with the structural, mechanical and electrical equipment and access thereto. Coordinate installation of recessed equipment with concealed ductwork and piping, and wall thickness.

1.06 SHOP DRAWING SUBMITTALS:

a. Shop Drawing and Product Data

1. Manufacturers' product cut sheets for required new equipment and major new and existing components to be provided. The product cut sheets shall be annotated to clearly identify only those specific functions and features that are applicable to the project.
2. System theory of operations that clearly define the operating parameters of all new and existing systems being supplied.
3. A functional systems block diagram showing single-line interconnection of all integrated systems and the major components of each system (new and existing) and methods of integration.
4. Touch Screen Maps illustrating facility and area layouts including sub-system control icons.
5. Conduit riser diagrams that show all required conduit, raceway (new and existing), wire, etc., for the interconnection of all systems equipment and devices. As a minimum, diagrams shall include raceway/conduit size and type, wire fill, (type and size), equipment identification and location.
6. Schedules of all electronic operated devices (new and existing) and their functional attributes for all systems being supplied. The schedules shall be divided by system (i.e., locking, CCTV, audio, lighting, watchtour, etc.) and shall be formatted in alphanumeric order by architectural identification number. As a minimum for each commodity entry, the schedules shall include the following:
 - a. Associated architectural number (i.e., door 108)
 - b. Assigned operation number (i.e., D108)
 - c. Hardware group (i.e., HW-1). This is a designation given to a standard set of complete hardware being utilized:
EX IC-1 consists of:
 - 1 5" Speaker P/NXXXX
 - 1 Baffle P/NXXXX
 - 4 Security Screws
 - d. Location of the control device, new and/or existing.
 - e. Functions associated with the controlled device (i.e., unlock switch, door position monitored, on/off switch, lock type, emergency push button, cell/egress group, interlock group, etc.).
 - f. Panel, enclosure or location of the function (i.e., field, panel F1, panel F2, etc.).
 - g. System designator that the commodities attribute is associated with (i.e., Logic System 1, Intercom System 1, etc.).
 - h. Type of function (i.e., input, output, internal Logic function).
 - i. The submittal shall include descriptive responsibility for all parties where the ESC must interface with other trades/contractors.
 - j. Included with the three (3) sets of submittals. The ESC must also provide one or multiple CD's that contains all submittal information as described

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

above (including manufacturer's cut sheets). The software programs utilized shall be the latest version of the following:

- a. Drawings – Auto CAD
 - b. Word Processing – Word
 - c. Spreadsheet – Excel
 - d. Database – Dbase
- k. The submittal shall reflect the systems as they are defined by the project plans and specifications, contract and signed/documented clarifications, substitutions and changes to the above documents by the Architect.
- l. The contractor shall not submit any shop drawings or product data that does not comply with the contract documents. Prior to submitting shop drawings, review submittal for compliance with contract documents and place a stamp or other confirmation thereon which states that submittals without such verification will be returned disapproved and without review.\
- m. If resubmittals are necessary, they shall be made as specified above for initial submittals. Resubmittals shall highlight all of the revisions made and the cover shall include the phrase “RESUBMITTAL NO. _____”.
- Resubmittal requirements do not entitle the contractor to additional time and are not a cause for delay of the project.
- n. The Architect reserves the right to require a sample of any equipment submitted for approval or to require a demonstration of any specific system. Where system demonstrations are required, such demonstrations shall be locally conducted at a time and place designed by the Architect.
- o. Review of shop drawings and product data by the engineer, including any review annotations or stamp notation, does not relieve the contractor from the required compliance with the contract documents.
- p. The shop drawing and product data review stamp notation requirements are defined As follows:
- q. “NO EXCEPTIONS”. The reviewer did not observe any items which were not in compliance with the contract documents. All dimensions, details and coordination with other trades shall be the responsibility of the contractor.
- r. “MAKE CORRECTIONS NOTED-RESUBMIT”. The reviewer indicated items observed which were not in compliance with the contract documents. The contractor shall resubmit showing corrections of all noted items. Delays for resubmittal do not relieve the contractor from meeting project schedules.
- s. “MAKE CORRECTIONS NOTED – DO NOT RESUBMIT”. The reviewer indicated items observed that were not in compliance with the contractor documents. The contractor shall not resubmit, but shall make corrections and provide corrected documents with the “Record Drawings”.
- t. “REJECTED”. The submission does not comply with the contractor requirements. The entire submittal must be corrected and submitted for review. Delays for resubmittal do not relieve the contractor from meeting project schedules.
- u. If shop drawings are submitted and returned as “NO EXCEPTIONS” or “MAKE CORRECTIONS NOTED – “ DO NOT RESUBMIT” and meet contract requirements, the contractor shall not resubmit any other shop drawings for these items.
- v. The initial submittal shall be made by the contractor in person, in the architect's office. The intent of this meeting is to conduct a general

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

review of the shop drawings to ensure all the pertinent information is incorporated in the submittal so the engineer can conduct a thorough review. The shop drawings shall be submitted in a timely fashion not to impede the progress of the project construction; this meeting is not intended to approve or disapprove the shop drawing submittals.

- w. See each Specification section within Division 28 for further shop drawing requirements.

1.07 RECORD DRAWINGS:

- A. At the time of final inspection, provide five (5) sets of complete data on Electronic Security equipment used in this project. This data shall be in bound form and shall include all shop drawings required for this project.
- B. Record drawings for LOCKING CONTROL AND DATA TRANSMISSION shall Include layout drawings of each programmable controller with each item of equipment Identified and cross referenced with equipment data sheet. Record drawings shall include complete terminal block schedule for each programmable controller with the following data for each point:
 - 1. Type of Point, i .e. input, output, analog, etc.
 - 2. Schedule relay points, terminal block numbers, and signal source or destination
 - 3. Input or output circuit configuration with nominal resistance or voltage values.
 - 4. Location and type of input source device
 - 5. Location and type of output device controlled
 - 6. Control wiring diagrams for all locking systems with each system identified
- C. All record drawings shall include:
 - 1. "As-built" system interconnection diagrams with major components identified and number and type of interconnecting conductors.
 - 2. Maintenance and operating instructions on all systems
 - 3. Certification from system manufacturers that systems are installed in accordance with manufacturers recommendations and are functioning correctly at the time of final inspection.
- D. Operating/Maintenance Manuals
 - 1. ESC shall furnish three (3) copies of parts of manual for all detention hardware, and all components of the electronic control system. These manuals shall include instructions for the care and operation of the systems and materials. A parts list to aid the owner with ordering replacement parts, as well as instructions for contacting the appropriate personnel not only during the warranty period, but also beyond.
 - 2. All programming software and source codes specific to this project, shall be included with the O & M Manuals. Omission of these will result in the forfeiture of retainage.

1.08 SECURITY COORDINATION MEETING:

- A. With-in 60 days after receipt of notice to proceed, there shall be a security Coordination meeting held at the architect's office. The meeting shall include attendance from the architect, engineer, construction manager, Division 28 detention equipment contractor, 28 contractor and Division 26 Contractor. The meeting is to discuss and coordinate the Electronic Security Systems.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Materials or equipment specified by the manufacturers name shall be provided, unless approval of other manufacturers is listed in any addendum to these specifications.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. Where a substitution of materials alters space requirements indicated on the drawings, submit shop drawings indicating the proposed layout of the space, and all equipment to be installed therein and clearances between equipment.
- C. All material shall be new and shall conform to the applicable standard or standards where such have been established for the particular material in question. All existing equipment shall be integrated, connected, tested, and proven operational within the system. Publications and standards of the organizations listed below are applicable to those materials specified herein;
 - 1. American Society for testing and materials (A.S.T.M.)
 - 2. Underwriters Laboratories (U.L.)
 - 3. National Electrical Manufacturer Association (N.E.M.A.)
 - 4. Institute of Electrical and Electronic Engineers (I.E.E.E.)
 - 5. National Fire Protection Association (N.F.P.A.)
 - 6. American National Standards Institute (A.N.S.I.)
- D. U.L. listed material shall bear U.L. label

PART 3 – EXECUTION

SYSTEMS OPERATIONAL TEST:

- A. Prior to the time of substantial completion the contractor shall conduct an operational test of each system comprising the total electronic systems to determine full compliance with the contract drawings. A technician that is employed full time by the manufacturer of each system shall be present to assist in the test.
- B. The manufacturers technical representative shall certify in writing that the systems are installed in compliance with the manufacturer's recommendations comply with the requirements of the contract documents and are operating correctly. These written certifications shall be submitted to the architect and shall signify that the total security system is operational and ready for final acceptance testing by the Architect.
- C. Final acceptance of the total security system shall be conducted by the contractor as directed by the architect. The contractor shall provide all personnel, equipment, instrumentation and communication equipment and shall include the cost of final acceptance testing in the base contract. These final acceptance tests shall generally consist of the following:
 - 1. Communication system including intercom and public address/monitoring Systems shall be tested by operation of all individual features and stations.
 - 2. The locking control and network system shall be tested concurrently with other systems to demonstrate alarm initiating, signal transmission, alarm display, automatic response function data storage and printout function, and alarm system interconnections with equipment furnished under other divisions of these specifications.
 - 3. All locking, CCTV, intercom, paging, and similar security systems shall be tested by operation of each individual device with status visual display observed.
 - 4. All individual, group and emergency release control functions shall also be tested at all control stations.
 - 5. All systems shall be tested under normal and emergency power. Where applicable systems shall be tested under battery power.

3.1 TRAINING

- A. The Contractor shall include in the base contract all costs required to train the Owner operating and maintenance personnel in the use and maintenance of systems provided under this division of the specifications. Training sessions shall be conducted by instructors certified in writing by the manufacturer of the specific system. Sessions shall be conducted for not less than four hour periods during normal working hours, i.e., Monday through Friday, 8:00 AM to 5:00 PM. Training

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

session schedules shall conform to the requirements of the owner; therefore such schedules shall be submitted to the owner for approval not less than two weeks prior to the training session. Training sessions for different systems shall not be scheduled concurrently. All training sessions shall be recorded for the owner. At owner's discretion, provisions shall be made to allow up to 2 owner's personnel to participate in final system check out of all systems.

B. Time to be included in base contracts for specified systems shall be as follows;

1. Intercom and paging system - 2 hours.
2. Locking Control – 4 hours
3. Closed Circuit Television – 2 hours
4. Utility and Lighting – 2 hours
5. Security Management System – 4 hours

3.3 WEATHERPROOF EQUIPMENT AND LOCATIONS

- A. Weatherproof equipment and locations are where weatherproof (WP) is indicated or where equipment is not located inside a building.
- B. Enclosures and boxes to be NEMA 3R hot dipped galvanized steel, weatherproof cast Iron or malleable iron boxes and covers, or NEMA 4X stainless steel.
- C. Mounting and support hardware to be hot dipped galvanized steel or stainless steel.

3.4 PROTECTION

- A. Provide covering and shielding for all equipment provided to protect from damage
- B. Protect nameplates on equipment, to prevent defacing
- C. Repair, restore or replace damaged, corroded and rejected items

END OF SECTION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 28: SECURITY ELECTRONIC SYSTEM
Section 28 46 19 - PROGRAMMABLE LOGIC CONTROL SYSTEM

PART 1 – GENERAL

1.01 Description

- A. The purpose of this project is to form a facility-wide, completely integrated PLC security solution. This entire system shall be purchased, engineered and programmed by a single Division 28 System Contractor.
- B. Logic control system shall be programmable controllers, which shall control all input/output functions of the security control stations. Cage mounted discreet cards and PLC units other than those manufacturers listed below will not be accepted.
- C. The central processing unit (CPU) shall be microprocessor based, encased in a shielded enclosure to provide RFI protection.

Note: *The logic control system shall be designed so that each control area (i.e., central control, housing unit) operates totally independent of one another. Failure or loss of any controller shall not hamper the operation of any other controller.*

1.02 Acceptable Manufacturers

- A. Except as otherwise specified herein, the equipment and materials of this Section shall be products of a single manufacturer engaged in the production of logic control systems for industrial applications for a minimum of ten (10) years. Controllers manufactured by the following are acceptable:
 - 1. GE Fanuc Automation, Charlottesville, VA
 - 2. Omron Electronics, Inc., Schaumburg, IL
 - 3. Square D, Albany, NY

1.03 RELATED WORK SPECIFIED ELSEWHERE

- A. The work of this Section is related to the work of the following Sections:
 - 1. Security Electronics Touch Screen Control Stations
 - 2. Closed Circuit TV System
 - 3. Intercom & Paging System
 - 4. Vehicle Loop Detector System
 - 5. Metal Equipment Cabinets, Racks and Turrets
 - 6. Uninterruptible Power Supply System
 - 7. Security Management System

PART 2 - PRODUCTS

2.1 SYSTEM REQUIREMENTS

- A. General: Provide a complete and fully functional PLC System using materials and equipment of types, sizes, and rating, as required to meet performance requirements. Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction, in accordance with published product information. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions.
- B. The programmable logic controller (hereafter referred to as the PLC) and all components in the controller system shall be the product of a company who regularly manufactures and services this type of equipment and who meets the requirements listed above. All assemblies and sub-assemblies performing similar functions in separate controllers purchased under this specification shall be interchangeable.
- C. All components of the programmable controller system shall be of normally recognized industry standards and regularly sold to the industrial market. All components shall be housed in structurally sound and finished metal cabinets. All switches and other operator-controlled devices shall be of the size and durability for their intended use as is normally offered for industrial applications.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- D. Modular components of the system shall be UL listed or recognized.
- E. The programmable controller shall be housed in enclosures hereafter referred to as SECURITY EQUIPMENT CABINETS (SEC'S). The SEC's shall house the following items:
 - 1. Input and output cards/modules related to the monitoring and control of security devices.
 - 2. Regulated power supplies.
 - 3. Surge/Lightning Protection.
 - 4. Terminal strips and fusing.
 - 5. Interposing door and lighting control relays.
 - 6. The programmable controller, and/or where applicable, transmitting and receiving modules to communicate with the PLC or remote input and output racks.
 - 7. CCTV Headend equipment (recording devices, etc.)
 - 8. The intercom amplifiers and switching relays.
 - 9. Other necessary items as determined by the Division 28 contractor's design.
- F. PLC inputs and outputs shall directly control and monitor the door control and other related security systems. Direct or 'hard-wired' connections to LED's (light emitting diodes), relays and other devices are not acceptable.
- G. Door Monitoring and Control: Unless otherwise stated, all electrically controlled and/or monitored doors shall be connected and controlled and monitored by the Security Automation System.
 - 1. Locks and sliding devices, whether solenoid or motor driven types, shall be controlled via mechanical interposing relays driven by the PLC. Solid-state relays are not acceptable. Provide all required power to control doors. If DC power supplies are required, the total ampacity shall be 100% greater than the worst case connected load, including in-rush current. Group or emergency openings of doors shall cause doors to SEQUENTIALLY OPEN such that power supplies will not be overloaded.
 - 2. Interlocks shall be via software. Any door shall have the ability to be programmed to become a member of an interlock scheme. The Architect shall reserve the right to re-define interlocks during the submittal phase without additional costs.
 - 3. Upon a loss of power, all doors shall de-energize (fail secure). Sliding and overhead doors shall remain in their present state when power is lost.

2.2 EQUIPMENT AND MATERIALS

- 1. The programmable logic controller (PLC), Communication modules, and the input and output modules shall be the products of one manufacturer.
- 2. Each PLC shall be password and key protected against unauthorized entry to software.
- 3. Each PLC processor shall have an Ethernet port or an accompanying Ethernet PLC module that directly interfaces the PLC processor directly to Ethernet.
- 4. Each input and output to the PLC system shall have LED indicators integrated into the input and output cards/modules that reflect the state of each input and output. I/O cards/modules shall be replaced without the need to unwire field connections. All field wiring shall remain intact on removable connectors.
- 5. PLC system shall have remote diagnostic indications. This includes PLC status and remote I/O status.
- 6. Provide each PLC system with the ability to be programmed remotely over a dial up connection.
- 7. Provide an EPROM for each processor provided.

2.3 Local Area Network Switches:

- 1. Provide an Ethernet Switch for the PLC & control panels/stations network.
- 2. Equipped with a minimum of eight (8) 10/100Base-T ports and fiber optic backbone.
- 3. Alarm relay outputs to signal a loss of port connection.
- 4. Configured to accept power from two independent 24VDC power supplies. Upon of power from the primary power supply, the switch shall automatically switch from the primary to the secondary power supply without loss of operation.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

5. Alarm relay outputs to signal loss of either power input, a fault in any port, or a permanent fault in the switch.
6. Front panel status LEDs.
7. IEEE802.3 compliant.
8. Manufacturer shall be Hirschmann (RS2 Rail Switch), Cisco, or HP.

2.4 SYSTEM OPERATION

A. PLC Control Software

1. PLC control software shall be commercially available software developed by one of the previously mentioned acceptable PLC manufacturers.
2. The control software shall be fully integrated with other required operations as defined in this section.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces and areas are ready to receive work.
- B. Verify field measurements are as shown on Drawings and as instructed by manufacturer.
- C. Verify that required utilities are available, in proper location, and ready for use.

3.2 INSTALLATION

- A. Field testing and inspection shall be as described in Section 28 40 00.
- B. Replace equipment, components, & wiring as required to achieve a fully functional system.

3.3 DEMONSTRATION, TRAINING, ACCEPTANCE

- A. Demonstration, training, and acceptance shall be as described in Section 28 40 00.

END OF SECTION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 28 SECURITY ELECTRONICS
Section 28 50 00 –TOUCH SCREEN CONTROL STATIONS

PART 1 - GENERAL
JOB OVERVIEW

- A. The purpose of this project is to form a facility-wide, completely integrated PLC/Touch screen based security solution.

1.1 RELATED DOCUMENTS

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. The work of this Section is related to the work of the following Sections:
1. Security Electronics
Touch Screen Control Stations
 2. Locking Control System - Theory of Operation
 3. Closed Circuit TV System
 4. Intercom & Paging System
 5. Inmate Call In System
 6. Vehicle Loop Detector System
 7. Metal Equipment Cabinets, Racks and Turrets
 8. Uninterruptible Power Supply System
 9. Security Management System
- B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this and other sections of Division 28.

1.2 SUMMARY

- A. This section includes the requirements and operational characteristics for Security Electronic Control System touch screen control stations comprised of the following equipment that is 100% integrated with the Security Management System:
1. Touch screen Computers & Monitors
 2. Touch screen Software

1.3 SYSTEM DESCRIPTION

- A. The Security Automation System touch screens are the primary user interface to the Security Automation System. Unless noted otherwise, all user-initiated control for the system is performed through these touch screens.

PART 2 - PRODUCTS

- A. Touch Screen Configuration Software: The touch screen configuration software shall be non-proprietary. The touch screen shall be developed using a standard Windows and Windows DDE based industrial software package that is regularly used in industrial applications and 100% compatible with the industrial PLC specified. The configuration software must be compatible with the PLC programming software. The configuration software manufacturer must have the facilities and a regular schedule for training so those individuals who receive the training will have the ability to develop or modify the touch screen configuration. The touch screen station is for operator interface only. All control functions are to be controlled by PLC software.
- B. Acceptable touch screen suppliers/manufacturers:
1. Wonderware
 2. Rockwell RS View w/RSLinx
 3. InduSoft.

2.1 SOFTWARE REQUIREMENTS

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. The Security Electronic System touch screens shall have the following software requirements to allow for seamless control and future flexibility.
- B. Primary Control/Secondary Control Icons:
1. Central Control shall have the ability to view all screens of the facility with status of all devices regardless of which touch screen has primary control of those devices.
 2. Icons for doors, intercoms, inmate call buttons, cameras, watch tour stations, etc, which are under primary control of Central (i.e. movement doors, exterior doors for sally ports, etc.) shall be displayed as standard icons as described in the sections to follow and can be controlled by Central.
 3. Icons, which are under primary control of the local touch screen, will appear on these same Central Control screens as 'sunken' into the screen with a passive or reverse video color. The status of DPS and LSS will be dynamically displayed as described in the sections to follow for both primary and secondary door icons. The intent is to allow Central Control to be aware of door movement in pods, booking areas, etc, while leaving control of those doors with the local touch screen.
 4. Local Touch screens shall display icons of doors, intercoms, cameras, etc, which are under primary control of Central and will appear on these same local Touch screen maps as 'sunken' into the screen with a passive or reverse video color. The status of DPS and LSS will be dynamically displayed as described in the sections to follow for both primary and secondary door icons. The intent is to allow the local touch screen to be aware of door movement in & out of Pod movement doors, booking area's movement doors & exterior sallyports and the vehicular sallyport, etc, while leaving control of those doors with Central Control.
 5. Takeover: The Central Control touch screens shall have the ability to take over or disable any combination of touch screens.
 6. Upon taken over from Central, all icons under primary control of the local touch screen will convert from the 'sunken' icons as described above to standard icons, allowing full control by Central.
 7. Upon takeover from Central, the intercom queue from the disabled stations will rollover intact to the Central Control's intercom queue.
- C. Touch screen Login Validation:
1. Each touch screen shall require Login Validation from the Security Management System via touch screen numeric keypad or pass wording.
 2. Login Validation will be integrated with the Security Management System's database to allow the tracking of the operator's name for all functions at each touch screen station until it is logged off.
 3. If the TCS cannot communicate with the SMS, then the TCS displays a "scrambled" numeric keypad for the operator to enter a PIN code.
 4. If the PIN code is valid the operator is logged in as the current operator of the station.
 5. An operator remains the current operator until a new operator is logged in or until the TCS is taken over or disabled
- D. Administration Viewing & Retrieval:
1. An Ethernet connection shall allow the retrieval of database information from the Security Management System's database with all reporting functions available for the PC stations via a local client and pass wording.
- E. MISCELLANEOUS
1. Each touch screen station shall be configurable to be able to control part or all of the facility.
 2. To move to another part of the facility, the operator can simply zoom to it (if the touch screen station is configured to do so). Zooming or paging to a new

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

screen and the status indicators on the screen shall be instantaneous. When an alarm condition occurs in an area that is not currently displayed, the touch screen will present this information to the operator. This information includes the status of doors in other areas and other conditions desired by the owner.

3. Floor plans must be displayed on the touch screen in the orientation of the station in the real world. Example: Doors in front of the operator will be displayed at the top of the touch screen; doors behind the operator will be displayed at the bottom of the touch screen.
4. On the CONFIGURE MENU, a 'TEXT DISPLAYED' selection shall be available so the operator may select between architectural text and owner text with one touch.
5. On the CONFIGURE MENU, a SIDE MENU LOCATION icon shall be provided so that the SIDE MENU can be alternated between the left and the right side of the screen, depending if the operator is left or right-handed.

F. OCCURRENCE LOG

1. Entry of new occurrence logs
 - a. User can enter text via the attached keyboard or option of using the software keyboard
 - b. Software keyboard shall include all standard keys including, shift, caps lock, backspace, enter, and arrow keys
 - c. As characters are pressed on the keyboard they should be displayed in the appropriate field
 - d. The software keyboard shall have a close button
 - e. The software keyboard shall hide after 10 seconds of inactivity, or any alarm, such as door violation, etc.
 - f. Press the submit button to save the entered text to the SMS computer
 - g. After submitted, status should indicate that the text has been sent and saved successfully, and the title and log fields should be cleared. If the text is not sent and saved successfully, the status should indicate "Log Entry Failed," and the title and log fields should not be cleared.
 - h. Press clear button to clear title and log fields
 - i. Press view log book button to view previous entries within the last 24 hours
 - j. Occurrence log entry shall be capable of 3800 characters
2. Viewing previous entries
 - a. Shall be capable of viewing 100 logged entries
 - b. The retrieval time shall be less than 10 seconds
 - c. Press the view log entry button to return to the new occurrence log entry screen
3. All data shall be logged by the SMS.
4. The OCCURRENCE LOG function shall be available by selecting the LOG button on the SIDE MENU.

2.3 TOUCH SCREEN CONTROL STATIONS:

- A. The touch screen stations shall consist of 32" high-resolution color flat panel LED/LCD monitors, surface acoustic wave touch screens, and PC compatible computers. The touch screen must operate simultaneously with a mouse so that the user can use either the touch screen or the mouse without reconnections, switches, or system re-boot. The stations shall be connected through a network that complies with requirements for IEEE 802.3 for 10BaseT Ethernet and 100BaseT Ethernet. 10BaseT is required so that other members of the network are not subject to problems associated with wiring or Ethernet ports of other network members. The PLC shall also be a member of the Ethernet network and communicate to all

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

touch screens. All touch screens shall communicate directly to the PLC independently of one another, and no one touch screen shall cause any other touch screen to not function. Server configurations where one computer serves as the communications server to the PLC is not acceptable.

1. Acceptable manufacturers: Except as otherwise specified herein, the equipment and materials of this Section shall be products of a single manufacturer engaged in the production of CPU's and monitors for industrial applications for a minimum of ten (10) years. Products manufactured by the following are acceptable:
 - a. Elo Touch Systems
 - b. NEC
 - c. DELL
 2. Touch screen Overlays: PCAP (TouchPro® Projected Capacitive):
 - a. The PCAP shall utilize a single glass panel design with no front layers or coating. Touch point activation shall be by piezoelectric transducers attached to the corners of the touch screen assembly.
 - b. Featuring: edge-to-edge glass and enabling up to 16 simultaneous touches. The clear glass touchscreen provides exceptional image clarity, resolution, and light transmission for vivid images and detail.
 - c. Response Time (Tr + Tf) (typical) 14 msec.
 - d. LCD Technology Active matrix TFT LCD.
 - e. Response Time (Tr + Tf) (typical) 14 msec.
 - f. Durability: Over 50 million touches in one location.
 - g. Positional Accuracy \pm 1.5mm.
 - h. Input Methods:
 - 1) Finger
 - 2) Gloved hand
 - 3) Passive stylus
- B. Touch screen Computer:
1. All computers shall have the following features:
 - a. Pentium Core i 7, 3.4 GHz processor, minimum
 - b. 2048 MB RAM capacity (minimum).
 - c. Configured with a minimum of 8 GB of RAM.
 - d. Hard Drives:
 - (1) Standard Terminals - Minimum 500 GB, 7200 RPM hard drive with maximum 9 msec access time.
 - (2) Main Terminals - Minimum three (3) 36 GB hot swappable, self-restoring, SCSI or IDE hard drives in RAID 5 configuration. If any of the hard drives fail during system use, the controller shall initiate an audible alarm or similar to alert the maintenance technicians to the failure.
 - e. Internal DVD RW/DVD+R Double Layer Drive with disk imaging software Symantec Ghost, Acronis True Image or approved equal.
 - f. Furnished with a monitor, keyboard, and mouse
 - g. Furnished with communications, video, and audio cards as required.
 - h. Shall be mounted in the console base.
 - i. Shall be powered by a UPS.
 - j. Shall contain a sound card and amplified speaker for special audio effects.
 - k. Virus protection software.
- C. Touch screen Configuration Software: Reference Part 2 Products
- D. PASSWORDS - The touch screen shall have 1000 passwords and 1000 different levels of security. The owner shall have an administration password that enables the owner the ability to alter passwords and password levels. The administration password shall be able to be changed by the owner.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- E. Touch screen Network Connections: The touch screen stations shall be connected through a network that complies with requirements for IEEE 802.3 for 10BaseT/100BaseTX Ethernet.
- F. Touch screen Integration: The touch screen is only an operator interface to the system. No control logic is allowed in the touch screen computer. All control logic is to be through the PLC. Touch screen stations must be able to control the same points and be able to be integrated into the same control system.
- G. Touch screen programming language: All touch screens will be programmed in English.

3.1 EXAMINATION

- A. Verify that surfaces and areas are ready to receive work.
- B. Verify field measurements are as shown on Drawings and as instructed by manufacturer.
- C. Verify that required utilities are available, in proper location, and ready for use.

3.2 INSTALLATION

- A. Field testing and inspection will be performed under the provisions of Section 28 40 00.

3.3 DEMONSTRATION, TRAINING, ACCEPTANCE

- A. Demonstration, training, and acceptance shall be as described in Section 28 40 00.

3.4 SPARES

- A. See Section 28 40 00 Security Electronic System.

END OF SECTION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 27 SECURITY ELECTRONICS
Section 28 51 23 - Intercommunication and Paging System - New and Existing

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.1 DESCRIPTION

- A. The intent of this contract is to provide an integrated digital intercom and communications system as described herein and indicated on the drawings fully integrating new and existing devices as specified herein.
 - 1. The system to include the following functions:
 - a. Door control intercom
 - b. Administrative (control room to control room) intercom
 - c. Zoned public address
 - 2. The system to integrate with the following other security and communication systems to form a completely integrated communication system:
 - a. Touch Screen control stations
 - b. PLC door control system
 - c. Closed circuit television system

1.02 APPROVED MANUFACTURERS

- A. Except as otherwise specified herein, the equipment and material of this Section shall be products of the following manufacturers. Product descriptions have been taken from Harding Instruments products and are meant to set a standard for quality and functionality only.
 - 1. Harding Instrument Co. Ltd.
 - 2. Zenitel, Kansas City, MO,
 - 3. TOA Electronics, San Francisco, CA

1.03 RELATED WORK SPECIFIED ELSEWHERE

- A. The work of this Section is related to the work of the following Sections:
 - 1. Security Electronics (28 40 00)
Touch Screen Control Stations
 - 2. Locking Control – Theory of Operation
 - 3. Closed Circuit TV System
 - 4. Vehicle Loop Detector System
 - 5. Metal Equipment Cabinets, Racks and Turrets
 - 6. Uninterruptible Power Supply System
 - 7. Security Management System

1.04 SCOPE OF WORK

- A. Work of this contract includes the supply and installation of an integrated intercom and communications system as specified herein to include all new devices and integration of existing remote devices as required.
- B. The system is to include all equipment, installation, installation materials, set up, and testing to form a complete operating system.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- C. Independent system functions and integrated system functions to be fully verified as part of system testing and commissioning.
- D. Work of this contract also includes the provision operating and maintenance manuals, training and demonstration, and extended warranty.

1.05 SYSTEM DESCRIPTION

- A. The integrated intercom and communications system to include the following components:
 - 1. Digital Communications Controllers (DCCs)
 - 2. Digital Communication Expanders (DCEs)
 - 3. Talkback Expanders (TBEs)
 - 4. Page Zone Expanders (PZEs)
 - 5. MicroComm DXL Administrator Software for configuring and maintaining the system.
 - 6. Master Module Stations
 - 7. Intercom stations
 - 8. Call operating devices
 - 9. Discrete input/output modules
 - 10. Auxiliary power supplies
 - 11. Audio program sources
 - 12. Paging amplifiers
 - 13. Loudspeakers and horn loudspeakers
- B. Digital Communication Controllers, Digital Communication Expanders and Talkback Expanders to be interconnected to form intercom exchanges capable of standalone local operation. Each Digital Communication Controller to be capable of supporting up to four Digital Communication Expanders and/or Talkback Expanders.
- C. Intercom system to consist of up to forty-eight exchanges networked together to form a fully integrated operating system. System capacity to allow for up to:
 - 1. 7680 analog intercom stations and 9600 VoIP intercom stations
 - 2. Intercom system to include ability to be controlled by graphic control panels, touch screen control stations and switch selector panels.

1.06 SYSTEM OPERATION

- A. The Master Module (MM) is to be used with touch screen control stations
- B. The MM consists of a push-to-talk (PTT) switch, a speaker (c/w rotary volume adjustment), and an electret microphone (c/w sensitivity adjustment). The MM base shall be brushed stainless steel.
- C. The MM shall have the microphone mounted on a 12-inch gooseneck.
- D. The MM shall be a self-contained unit and shall provide contacts for an external PTT switch as well as stereo line level output jack for driving an external amplified speaker.

1.07 Call placement from an intercom station: (See Theory of Operation, Division 28).

1.08 Paging: (See Theory of Operation, Division 28)

1.09 CCTV interface: (See Theory of Operation, Division 28)

- A. System to transmit command signals to the CCTV controller to route camera signals to spot monitors.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1.10 FUNCTIONAL REQUIREMENTS

- A. Identification numbers for each category of device, group, zone, etc. to range from 1 to 99,999.
- B. All intercom station field wiring to be supervised for short circuit and open circuit faults.
- C. All system boards to include self-diagnostic functions for complete operational and communication testing.
- D. DCC's and DCE's and other devices to be capable of insertion or removal from service while the system is fully operational. Other system activity not directly related to the unit's insertion or removal to not be affected.
- E. System diagnostics to include the ability to test system communications and devices from the front panel keyboard on the DCC's.
- F. System to include the ability to make on-line changes to the system configuration.
- G. System to include logging functions for system activity and system maintenance.
- H. On-line factory support to be available through a modem installed in the DCC.

1.11 PERFORMANCE REQUIREMENTS

- A. System frequency response: 300 to 3,500 Hz.
- B. Intercom station output: 82 dB SPL at 3 feet with 82 dB SPL input at face of transmitting station.
- C. All system equipment to comply with the radiation limits for Class A digital devices of FCC Rules Part 15, Subpart B.

2.0 PRODUCTS

- A. DIGITAL COMMUNICATION CONTROLLERS (DCC's)
 - 1. Digital Communication Controllers to each form an intercom exchange capable of independent local operation. Exchange capacity to be increased by connecting up to four Digital Communication Expanders to each DCC.
 - 2. Multiple DCC's to be networked together via digital audio trunks and/or Ethernet data networks to form larger systems. VoIP enabled systems shall utilize IEEE 802.1p/Q Quality of Service (QoS) compliant Ethernet networking equipment. Each DCC to include:
 - a. Process Control Card (PCC)
 - b. Master Control Card (MCC)
 - c. Two Station Control Cards (SCCs)
 - d. An optional internal PCI card (Lonworks or VoIP accelerator card)
 - e. A front panel keypad/display for system setup and maintenance.
 - f. A 110 VAC, 60 Hz power supply for internal functions.
 - 3. Process Control Card:
 - a. Process Control Card to contain system configuration and data, control exchange operations and switching, and provide exchange network ports.
 - 4. Process Control Card to include:
 - a. USB network ports for exchange expansion.
 - b. Ethernet network ports for system expansion and external control by touch screen computers and graphic control panels.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- c. Fiber optic or copper digital audio trunk ports. (not required for VoIP over d. Ethernet audio trunking)
 - d. Two serial ports.
 - e. An internal modem for transmitting and receiving data over a telephone line.
 5. Master Control Cards:
 - a. Include ports for any combination of two intercoms or telephone set master stations.
 - b. Include two line level audio inputs with status and control.
 - c. Include two line level audio outputs with status and control.
 - d. Convert incoming audio signals to digital format and outgoing signals to analog format.
 - e. Intercom audio and press-to-talk status transmitted over two single shielded pair cables with wiring supervision to detect open circuit and short circuit faults.
 6. Station Control Cards:
 - a. For each provide sixteen half-duplex intercom station ports which can be employed in adjacent pairs for full duplex devices.
 - b. Provide an interface for intercom stations.
Units to convert incoming audio signals to digital format and outgoing signals to analog format. Each channel to monitor the status of up to two (2) switches associated with each intercom station.
 - c. Each card interfaces with 16 half-duplex channels. Each channel includes a separate audio power amplifier for non-blocking call operation and sixteen (16) independent software controlled volume settings.
- B. DIGITAL COMMUNICATION EXPANDERS (DCE's)
 1. Digital Communication Expanders to provide Master Module and intercom features similar to the DCCs to facilitate exchange expansion.
 2. Each DCE to include:
 - a. A Process Control Card (PCC) without exchange control or network functions.
 - b. A Master Control Card (MCC)
 - c. Two Station Control Cards (SCCs)
 - d. A 110 VAC, 60 Hz power supply for internal functions.
 3. TALKBACK EXPANDERS (TBEs)
 - a. Talkback Expanders to provide 8 amplified paging outputs that can drive 25 Vrms loudspeaker circuits.
 - b. Each TBE is to;
 - 1) Provide 5 watts output per channel
 - 2) Allow adjacent channels to be bridged to obtain higher power.
 - 3) Provide talkback capability on all channels.
 - 4) Include Audio Level Alarm capability on all channels.
 4. PAGE ZONE EXPANDERS (PZEs)
 - a. Page Zone Expanders to provide 3 page inputs (from an audio amplifier) with each input having 6 selectable relay controlled outputs.
 - b. Each PZE input to include:
 - 1) 1 ea. relay controlled output for each input that can be used to key an audio amplifier.
- C. ADMINISTRATOR SOFTWARE
 1. Administrator Software to function on a standard PC to support system configuration, diagnostics, maintenance, and logging but not be required for system operation.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2. Administrator Software to employ Windows features including views of system tree structure, tables of devices, screens for system settings and adjustments, and tables of operational data.

D. DISCRETE I/O MODULES

1. Each Discrete I/O (input/output) module is to interface up to 48 contact closure type input monitor points and 48 solid-state (16 relay, 48 relay) output control points. Outputs are to be current sink (voltage source, LED driver, form C contact) type.
2. Inputs are to be supervised (non-supervised) for open circuit and short circuit faults in field wiring. With terminating resistors, each supervised input is able to monitor two contact points for a total of 96 inputs.
3. DIO modules to be rack or wall mounted.

E. NETWORK REPEATERS

1. Network repeaters are to extend LonWorks network cable limits or increase node limits. Each unit is to include four network ports. Data received on any port to be re-transmitted on the other ports.
2. Units to be surface wall mounted and include screw terminal connectors, redundant power supply connections and internal fuse to protect circuitry.
3. Six (6) LED's to indicate receiving port, network activity, and power supply status.

F. ANALOG INTERCOM STATIONS

1. Intercom stations are to be designed for mounting on standard 2-gang outlet boxes. Faceplates to be constructed of 11gauge brushed stainless steel. Internal steel offset grille to restrict inserting objects through speaker grille. Stations to be ruggedly constructed and resistant to damage from soil and sprays.
2. Each intercom station is to incorporate an internal loudspeaker, microphone preamplifier and function multiplexing circuitry. One pushbutton is to be provided on each station. Pushbuttons to be software assignable for placement of call requests or control of auxiliary functions.
3. Pushbuttons to be vandal resistant and of stainless steel. Switch to have positive tactile action with 1 million-operation lifetime.
4. Loudspeakers to be waterproof Mylar cone type.
5. All intercom station functions to be transmitted over a single shielded pair cable. Stations to be provided with MTA type insulation displacement connector that requires no wire stripping for installation.
6. Outdoor intercom stations are to be identical in all respects to standard intercom stations except that all metal plates and hardware to be stainless steel, and internal circuitry and components to be conformally coated.

G. PAGING AMPLIFIERS

1. Provide paging amplifiers and zone switching as required to perform the functions described herein and indicated on the drawings.
2. Paging amplifiers to be the constant voltage output type with power output capacities to drive the loudspeakers connected at sufficient levels with no more than 90% amplifier loading.

H. PAGING LOUDSPEAKERS

1. Loudspeakers to be nominal 8" diameter dual cone type units. Loudspeakers to incorporate 6-ounce permanent magnet and include a 5-watt multi tap transformer for use on 25-volt and 70-volt constant voltage type distribution systems.
2. Each loudspeaker to be provided with a standard (security) baffle plate and flush (surface) mounted enclosure. Baffle and enclosure to be all metal construction and finished in polar white baked on enamel.

J. PAGING HORNS

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

1. Paging Horns are to be weatherproof compression driver units with integral screwdriver adjustable multi-tap transformer for use on both 25-volt and 70-volt constant voltage distribution systems. Integral mounting plate suitable for mounting on a standard outlet box is to include a swivel type alignment bracket.
2. Units are to be rated to handle 15 watts input power. Nominal sensitivity 110 dB SPL at 3 feet with 1 watt input.

3. EXECUTION

3.0 GENERAL INSTALLATION PROVISIONS

- A. Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in the Contract Documents.
- B. Precautions shall be taken to guard against electrostatic and electromagnetic susceptibility and interference.
- C. Provide adequate ventilation for all heat radiating equipment.
- D. Install equipment so as to provide maximum safety to the operating and maintenance personnel.

3.1 INSTALLATION

- A. Provide complete integrated intercom and communications system as indicated on the drawings and specified herein.
- B. All material furnished shall be new and conform to the applicable requirements of the Underwriters Laboratories and the National Standards Institute.
- C. Unless otherwise noted, all wiring is to be installed in conduit or wireways.
- D. All system equipment to be contained within equipment racks, cabinets, or closets. If more or larger racks or cabinets are required than exist or are indicated on the drawings, allow for such additional equipment racks and cabinets in contract price.
- E. Wiring shall be executed in strict adherence to standard broadcast practices.

3.2 TESTING, ADJUSTING, AND BALANCING

- A. Except where otherwise specified, arrange for testing, adjusting and balancing of system.
- B. If test results do not conform to applicable requirements, repair, replace, adjust, or balance equipment and systems. Repeat testing as necessary until acceptable results are achieved.
- C. Log and tabulate test results on appropriate test report forms and as specified.
- D. Submit copy of completed test report forms to General Contractor immediately after tests are performed.
- E. Insert a copy of completed test report forms in each copy of the operating and maintenance manuals.
- F. Testing, adjusting, and balancing to verify the full and proper operation of each system component and integrated function.

3.3 DEMONSTRATION AND TRAINING

- A. Demonstration, training, and acceptance shall be as described in Section 28 40 00.

END OF SECTION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 28 SECURITY ELECTRONICS
Section 28 60 00 - Security Control System – Theory of Operation

PART 1 – GENERAL

1.01 DESCRIPTION

- A. The work included under this section of the specifications consists of furnishing and installing a complete security control system in accordance with Division 28000 under a single Security Electronics Control contractor. Provide all labor, equipment, materials, and supervision to install, calibrate, adjust, document, and test the total integrated system as required herein and on the drawings.

1.02 SYSTEM OVERVIEW

- A. The security control system shall control and monitor all electrical controlled hardware, gates and doors, and other system devices as indicated. The system shall monitor and annunciate the status condition of all electrical equipped hardware, doors, grates, control conditions, security conditions, call-in signals, and other functions as described herein. The system shall perform logic functions to provide operational characteristics as described herein. The system shall interface with Division 26 for dayroom lighting and T.V. on/off control.

1.03 SYSTEM CONFIGURATION

- A. The security control system is mainly configured from touchscreen control workstations; PLC's including power supplies, CPU's, I/O boards, relays, termination equipment, wiring, conduit and other devices as required.
 - 1. Security control panels:
 - a. Security control touchscreen stations shall provide for various control functions, audible alarms, and visual annunciators which shall provide control and annunciation between the staff and the security control system(s) as specified herein.
 - 2. Logic units:
 - b. The Programmable Logic Controller (PLC) units shall provide all necessary logic transactions necessary to implement the functional operation of the system(s) as specified herein and other related specification sections.
 - 3. Relay terminal equipment
 - c. The relay terminal equipment shall provide terminal facilities for field wiring and shall contain relay equipment for the conversion of low energy system control to high energy control output signals as necessary to control and/or operate devices as specified herein.
 - d. Where used for control of power equipment i.e. lighting circuits, receptacle circuits, etc., provide 20 amp interposing relay.

1.04 THEORY of OPERATION - TOUCH SCREEN CONTROL STATIONS:

- A. Global Function Operations
 - 1. All electrically controlled hardware and security subsystems end-of-line devices as indicated herein shall provide status and control by use of symbolic icons and status indicators. All control icons (switch functions) that are used shall be of a size that will facilitate a positive touch point; the minimum size of 0.5 inch square shall be required. All status indicators shall be a minimum of three sixteenths inch in diameter or a large, square or rectangle symbol may be used at an equal size. All symbols shall provide status by its color and/or associated text, both the control icons and its associated status indicators. Global function icons shall be

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

located on the bottom of each touch screen. These icons, if active, shall control global functions for the associated graphically displayed area.

a. Log-off

- 1). Touching this icon shall cause a pop-up verification window to appear on top of the graphically displayed area. Located within this window there shall be a text prompt requesting the correction officer if they wish to proceed with the Log Off function. Also located within the window shall be two icons. One shall have the text "YES" and one shall have the text "NO". Touching the icon with the text "NO" shall cause the verification window to be removed from the screen and the system shall return to normal operation. Touching the icon with the text "YES" shall cause the verification window to be removed from the screen and shall cause the current operator to be logged out of the Touchscreen Operator Interface Console (TIC). The console shall return to the primary log-on screen awaiting a new operator to log-in on this console.

b. System Utilities

- 1). Touching this icon shall cause the system to switch to the System Management Screen. The functions located on this screen will be based upon the access level that the current operator has obtained. Specialized functions will be disabled and grayed out if the access level is not acceptable. The Systems Management Screen shall consist of, but are not limited to these function:
 - a). Configure Users
 - b). Change Password
 - c). Touchscreen Calibration
 - d). Set Date and Time
 - e). Clean Screen

- 2). The system utilities operation shall be menu driven with on-line help.

c. Site Plan

- 1). Touching this icon shall cause the system to display a touch screen map which shows the entire site plan. The site plan global map shall provide the operator with a quick method to access an individual area to monitor and/or control. This function shall only be required on TIC's that need the capability of control and monitoring of the entire site.

d. Area Maps

- 1). Touching this icon shall cause the system to display a touch screen map which shows the entire area in which the system is viewing at that time. This is to allow the operator a quick method to access another detail section within that area.

B. Locking Operations

1. Door Position Status (Monitored Only)

- a. There shall be a status icon for each monitored door to indicate the position of the door. The status icon shall illuminate red when the door is unsecured and shall be green when the door is secure.

2. Interlock Group Status

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. Touching a lock symbol that is a door of an interlock group where one or more doors are open, shall cause a pop-up window to appear on top of the graphically displayed area. Located within this window shall be text explaining to the operator that the lock symbol they touched is part of an interlock group and that interlock override needs to be used to open this door. Also located within this window there shall be an icon with the text "OK". Touching the icon with the text "OK" will acknowledge that they understand the explanation and shall cause the pop-up window to be removed from the screen and the system shall return to normal operation.
3. Interlock Override
 - a. Touching this icon shall cause a pop-up verification window to appear on top of the graphically displayed area. Located within this window there shall be a text prompt requesting the correction officer if they wish to proceed with the Interlock Override function. Also located within this window there shall be two icons, one shall have the text "YES" and one shall have the text "NO". Touching the icon with the text "NO" shall cause the verification window to be removed from the screen and the system shall return to normal operation. Touching the icon with the text "YES" shall cause the verification window to be removed from the screen and shall cause the indicator within the Interlock Override Function icon to change to yellow indicating that the override function is active. The Override Function shall only remain active for 10 seconds. Touching a door control icon while override is active shall cause the associated door to unlock or open. When the override time limit is reached, the system shall return to normal.
4. UNLOCK Icon
 - a. There shall be a control icon with a visual status icon that will provide control for locks. Touching the UNLOCK icon shall apply power to the lock and activate the UNLOCK cycle. The associated status icon shall illuminate red when the lock is unsecured and shall be green when the lock is secured.
5. UNLOCK/LOCK Icon
 - a. There shall be a control icon with a visual status icon that will provide control for locks. Touching the UNLOCK/LOCK icon shall either activate the UNLOCK cycle or the LOCK cycle of the lock. The associated status icon shall illuminate red when the lock is unsecured and shall be green when the lock is secured.
6. OPEN/CLOSE Icon
 - a. There shall be a control icon with a visual status icon that will provide control for locking devices. Touching the OPEN/CLOSE icon shall either activate the OPEN cycle or the CLOSE cycle of the locking device. The associated status icon shall illuminate red when the locking device is unsecured and shall be green when the locking device is secured.
7. OPEN/CLOSE/STOP Icon
 - a. There shall be control icons with a visual status icon that will provide control for locking devices. Touching the OPEN icon shall activate the OPEN cycle of the controlled device. Touching the CLOSE icon shall activate the CLOSE cycle of the controlled device. Touching the STOP switch while the device is in the OPEN cycle or CLOSE cycle shall STOP the device. The associated status icon shall illuminate red when the locking device is unsecured and shall be green when the locking device is secured.

8. Emergency Release Icon

- a. Touching this icon shall cause a pop-up verification window to appear on top of the graphically displayed area. Located within this window there shall be a text prompt requesting the operator if they wish to proceed with the Emergency Release function. Also located within the window shall be two icons. One shall have the text "YES" and one shall have the text "NO". Touching the icon with the text "NO" shall cause the verification window to be removed from the screen and the system shall return to normal operation. Touching the icon with the text "YES" shall cause the verification window to be removed from the screen and shall cause the associated emergency doors for that area to be unlocked. This function shall remain active for 10 seconds. While active, the associated indication shall be flashing orange. When the Emergency Release time limit is reached, the system shall return to normal.

9. Group Assign Icon

- a. Touching this icon shall cause the system to go into the Group Assign Mode. While active, the status icon shall be illuminated blue. Touching an assigned cell lock or locking device in a defined group shall assign or remove this lock or locking device from group functions. The status icon on the assigned lock shall be black if that device has been excluded from a group function. Touching the group assign icon a second time shall cause the system to return to normal operation.

10. Shunt Mode Icon

- a. Touching this icon shall cause the system to go into the Shunt Mode. While active, the status icon shall be illuminated. Yellow. Touching a cell lock icon shall prevent that device to receive any door access alarms. The status icon on the associated lock shall be yellow if that device has been shunted from the door alarms. Touching the Shunt Mode icon a second time shall cause the system to return to normal operation.

C. Intercom Operations

1. Intercom System

- a. There shall be a control icon with a visual status icon that will be used to select, answer and reset audio communications between a calling staff station and the touch screen operator.

1). Staff Station Call-Up

- a). Operator selection of a staff station

1. Touching a staff station icon shall open a talk path between the operator and the associated staff station. The associated status icon shall illuminate yellow. Touching the staff station icon a second time shall close the talk path and the status icon shall extinguish.

- b). Control Room to Control Room Communications

1. Typical staff station to the control panel operation described above

2). Remote Staff Station Call-In

- a). Upon activation of a remote staff station's call-in switch, the associated status icon shall illuminate and the flash between yellow and gray with an audible tone.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

Touching the associated staff station icon shall open a talk path between the operator and the staff station. The status icon shall illuminate yellow and the audible tone shall silence. On completion of communications, touching of the staff station icon a second time shall close the talk path and the associated status icon shall extinguish.

D. Closed Circuit Television (CCTV) Operations

1. CCTV Camera Select

- a. Touching a camera icon shall cause the associated camera to be switched to the spot monitor of the CCTV system. Touching the icon a second time shall remove the associated camera from the CCTV spot monitor or touching a different camera icon shall cause any other camera to be removed from the spot monitor and the newly selected camera to be viewed on the spot monitor. Touching this icon shall cause the screen to return back to the screen previously displayed.

E. Lighting Operations

1. ON/OFF Icons

- a. There shall be a control icon with a visual status icon that will provide control for area lighting and/or individual lights. Touching the ON/OFF icon shall either turn on or turn off the associated light fixture(s). The status icon shall illuminate yellow when the lighting is on and shall be gray when the lighting is off.

F. Auxiliary Operations

1. General Alarm Condition

- a. There shall be a status icon which will illuminate and flash red with an audible tone to indicate a device initiated alarm condition. Touching the silence icon shall silence the audible tone and illuminate the status icon a steady red. The status icon shall disappear when the device returns to normal operation. The following conditions are able to initiate general alarm conditions.

- 1). Network Trouble
- 2). Controller Fault
- 3). Emergency Power Status

2. TV Receptacle ON/OFF Icon

- a. There shall be a control icon with a visual status icon that will control power to dayroom televisions. Touching this icon shall turn on or turn off the associated power receptacle. The status icon shall turn on or turn off the receptacle. The status icon shall illuminate yellow when the receptacle is on and shall be gray when off.

3. Shower Valve ON/OFF Icon

- a. There shall be a control icon with a visual status icon that will control power to solenoid valves that control the inmate showers. Touching this icon shall turn on or turn off the associated solenoid valve. The status icon shall illuminate yellow when the valve is on and shall be gray when off.

4. Satellite Power ON/OFF Icon

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. There shall be a control icon with a visual status icon to control all remote TIC stations. Touching this icon shall turn on or turn off the associated TIC station. The status icon shall illuminate green when the associated satellite graphic panel is on and shall illuminate red when the associated graphic panel is off.

G. Interactive Alarm/Audio Handling and Operation

1. The system shall be provided with an interactive activity window for alarm and audio call-in handling. Activation of any point identified as an alarm point or an audio call-in shall generate a queue entry in the activity window with a descriptive text message. Touching the "Select" icon shall automatically switch the operator to the screen map displaying the alarm point and/or audio station. The system shall also automatically select, as applicable, the calling intercom station without additional operator action. The activity window shall display up to five (5) queue entries and be provided with scroll buttons to scroll through additional queue entries.
2. The system shall provide 25 levels of alarm priorities. Queue entry into the activity window shall be chronological by priority level. The higher priority alarms shall be at the top of the queue. The queue entries shall also be color coded into three groups to provide immediate level recognition. Priority levels 1-100 shall be color coded green; priority levels 101-200 shall be color coded yellow; and priority levels 201-155 shall be color coded red.
3. All alarm points shall be logged to the Alarm Log with the following minimum information:
 - a. Time and date of alarm activation
 - b. Alarm point name (Owner configured)
 - c. Time and date of acknowledgment
 - d. Time and date of reset
 - e. Operator handling alarm

1.05 RELATED WORK

- A. Work under this section of the specifications shall be coordinated with equipment provided under the divisions of the specifications and under the other sections of the division. Requirements in other sections and divisions which require work, materials and/or functional characteristics of systems in this section shall be furnished under this section provided they do not conflict with requirements contained in this section. Conflicts shall be brought to the attention of the Architect before ten days prior to bidding otherwise the conflict shall be resolved by the contractor at the direction of the Architect with no additional cost. Other provisions of the specifications with related work included but are not necessarily limited to the following:
 1. General (Div. 01010)
 2. Detention Equipment (Div. 11190)
 3. Mechanical (Div. 23)
 4. Electrical (Div. 26)

PART 2 – DESCRIPTION

2.01 WIRING SPECIFICATION

- A. The work under this section of the specifications includes the installation of all wiring for the electric operated locks, gates and doors, for all locks. Some locks, wire, conduit are existing. The actual connections to individual locks, door, and gates and the actual connections in the control panels and consoles shall be made by the Division 28 contractor.
- B. Power wiring for sliding doors solenoid operated locksets operating at 24 volts, shall be No. 16 THWN or XHHW (not overhead doors). Motor operated and solenoid operated locksets

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

operating at 24 volts A.C. or D.C. shall be connected with No. 16 MTW conductors. Provide power wiring for motor driven sliding gates requiring separate power and control wiring. Power to sliding interior doors shall be from control voltage serving locking controls. All power wiring for 24 volt or 120 volt locks shall be equipped with a separate grounding conductor.

- C. All new wiring for status indicators shall be signing circuits as defined by Article 725 of the National Electrical code, 2020 Edition. All conductors shall be No. 16 MTW and shall be installed in common raceways and equipment enclosures with other conductors for locking devices within limitations defined by Article 725-15 of the National Electrical Code.
- D. All new wiring systems shall use stranded copper conductors. Provide labor to connect field wiring to Molex connector provided by security hardware contractor.
- E. All new wiring systems shall be Class II wiring and shall be individually color coded. All colors shall be continuous from field device to last internal termination point. All colors shall be consistent as to function, i.e., Red-24VDC pos., Black-24VDC neg. White or gray conductors shall be used only for neutral conductors and green only for grounding conductors.
- F. All new conductors within junction boxes, pull boxes and equipment enclosures shall be grouped and laced with nylon tie straps with identification tab, in individual sets serving individual lock sets or operating mechanisms. Conductor groups shall be identified on the strap tab with respect to room or operator served.
- G. Locking system conductors shall not be spliced; conductors shall be continuous between lock sets and/or operators and termination point for control.
- H. Junction boxes and pull boxes required for installation of the locking system wiring must be installed to be fully accessible as required by the National Electrical Code. Work under this section of the specification must be closely coordinated with work of all other trades to comply with this requirement.
- I. Junction boxes and pull boxes shall not be installed in areas accessible to inmates.
- J. Where junction or pull boxes are installed outdoors, boxes shall be cast metal type with conduit hubs as required, flush mounted, checkerboard type cover held in place with brass screws and full neoprene gasket. Box shall be set in concrete with concrete dimensions exceeding box dimensions by not less than three inches on all sides and bottom.

2.03 CONTROL POWER TRANSFORMER

- A. Control power transformers shall be provided for each security control panel and where required for the system. Transformer shall be provided with fused secondary 24 output unless otherwise indicated on the drawings or specified herein. Transformer shall be rated for not less than 200% of load imposed on transformer of most severe loading condition. Minimum Size of control power transformer shall be 750 V.A.

2.04 POWER SUPPLY

- A. Provide low voltage D.C. power supply units for each security control panel and as required to provide 24 volt regulated, filtered D.C. power for locking controls and signal devices. Output power shall be 24 volt D.C. with ampere rating not less than 150 % of load imposed on power supply under most severe conditions of load. D.C. output shall be fused. Output voltage shall be regulated within plus or minus 5% from no load to full load.
- B. Each power supply shall be rated for more than 15 AMPS D.C. (maximum connected load of 10 amps including inrush current).

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- C. Where low voltage D.C. requirements for control devices operated at maximum load exceed output of a single power supply, multiply power supplies shall be provided and loads subdivided to prevent overloading power supply unit.

2.05 GROUNDING

- A. Furnish and install a copper grounding plate (0.25" x 4" x 20" by Erico Electrical Products or equal) inside the locking relay cabinet; in addition bond the copper grounding plate to the cabinet and all entering conduits using #10 AWG bare copper wire.
- B. Furnish and install a #2 AWG bare ground from the copper grounding plate in the relay cabinet to rebar in the concrete slab and the structural steel by the chemical weld process.
- C. The green conductor at the lock pocket shall be boned to the hollow metal frame.
- D. Where surge protection is provided the protected wiring should never cross or come in close proximity to the unprotected wiring.

2.06 SPARE COMPONENTS

- A. Furnish the following spare components:
 - 1. Cad file of touch screen maps or graphic control panels
 - 2. Final Touch Screen Software and programming information

PART 3 – EXECUTION

3.01 Touch Screen Control Stations

- A. Touch Screen monitors shall be installed on top of the counter tops (millwork) provided under other sections of these specifications.

3.02 SHOP DRAWINGS

- A. Certification of hardware coordination: Prior to preparation of shop drawings for Security control systems, review the electrical and operational characteristics of each electrically controlled and monitored hardware type to be installed on this project. Submit, with shop drawings; written certification that the locking control system has been configured to be both electrically and functionally compatible with the hardware.
Shop drawings for touch screen maps shall contain layout drawing at not less than ½ full scale illustrating graphic layout, orientation for area served, and all devices to be installed in panel.
- B. Shop drawings for security equipment cabinets shall include cabinet dimensions and layout of all equipment to be installed within cabinets.
- C. Shop drawings shall include specification and data sheets on all control devices, pilot lamps, auxiliary relays, control power transformers, power supplies, terminal boards conductors, lugs, PLC's, etc.

END OF SECTION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 28: SECURITY
Section 28 70 00: INMATE CALL SWITCHES

PART 1- GENERAL

1.1 DESCRIPTION

- A. Provide pushbutton switches where indicated on the drawings, for use by the inmates to initiate a call-in to a control room, which alerts the control officer that the inmate wishes to communicate with him. This switch shall cause the audible alarm to sound and the associated indicator on the control panel to illuminate.
- B. The system to integrate with the following other security and communication systems to form a completely integrated communication system:
 - 1. Touch Screen control stations
 - 2. PLC door control system

1.2 Acceptable Manufacturers:

- A. Except as otherwise specified herein, the equipment and materials of this Section shall be products of the following manufacturers:
 - 1. Quam, Chicago, IL
 - 2. ABC Control Systems Inc., Buena Park, CA
 - 3. Dukane, St. Charles, IL
- B. Construction: The switch shall be of the low voltage type requiring no more than 24DV for operation. The switch shall be mounted on a subplate along with a terminal strip for field connections.
 - 1. The switches shall employ a limited force actuator design with a momentary call position. The switch faceplate shall be 11-gauge. The switch shall use factory supplied 3" pigtails for ease of field wiring termination. The call-in switches shall be designed to mount to a standard single-gang electrical box and/or directly in the security hollow metal door frame.

PART 2 – EXECUTION

1. QUALITY ASSURANCE

- A. Quality Assurance shall be as described in Section 28 40 00.

2. EXAMINATION

- A. Verify that surfaces and areas are ready to receive work.
- B. Verify that required utilities are available, in proper location, and ready for use.

3. INSTALLATION

- A. Field testing and inspection will be performed under the provisions of Section 28 40 00
- B. Replace equipment, components, and wiring as required to achieve a fully functional system.

4. DEMONSTRATION, TRAINING, AND ACCEPTANCE, SPARE PARTS

- A. Demonstration, training, and acceptance shall be as described in Section 28 40 00.
- B. Spare Parts shall be as required in Security Electronic Control Section 28 40 00.

END OF SECTION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 28 SECURITY ELECTRONICS

Section 28 74 00 – UNINTERRUPTIBLE POWER SUPPLY SYSTEM

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Provide uninterruptible power for back-up of all intercommunications equipment, closed circuit TV, logic control system (including all annunciator inputs) and the security control station(s). The UPS system shall independently receive its power supply directly from the main/emergency power supply of the facility. The UPS system shall have the capacity to furnish the required total power for not less than thirty (30) minutes. If there is no emergency generator or other back-up power available, the requirement will be two (2) hours. In the event of failure of the normal and emergency power sources, the UPS system shall have visual and audible trouble indicators and annunciate on the security control station(s).

- B. Acceptable Manufacturers
 - 1. Except as otherwise specified herein, the equipment and materials of this Section shall be products of the following manufacturers:
 - a. Sola Electric, Elk Grove, IL
 - b. Powerware, Necedah, WI
 - c. Deltec, San Diego, CA

1.02 Construction

- A. The uninterruptible power supply shall have an output voltage of 120 volts and a full load current capable of supplying all systems indicated herein. The unit shall operate with an input voltage of 120 volts, single phase, 60 cycle for units with outputs of 2.2kW or less. For units with outputs greater than 2.2 kW, input voltage shall be 208/240 volts, single phase 60 cycles. The output frequency stability when operating without an input (inverter mode), shall be not less than $\pm 0.25\%$. Static voltage regulation shall not exceed $\pm 3\%$ with a dynamic regulation of at least $\pm 10\%$ for any load change not to exceed 20% of full load rating.

- B. The unit shall operate normally with a $\pm 10\%$ input voltage with an 0.85 power factor, from 0 degrees to 40 degrees C in a humidity of 0% to 95% and shall deliver 150% of rated power for 20 seconds and 125% for 10 minutes.
 - 1. In the event of a loss of AC input power, the unit shall automatically switch to inverter power with no noticeable change of output power. Output power shall remain constant during transfer to/from input AC line power or DC source inverter power. In the event of an inverter malfunction, the unit will indicate and sound an inverter malfunction alarm and the inverter will shut down. The inverter shall shut down and drive an alarm when the input voltage drops below 95 volts DC.
 - 2. Batteries: The batteries shall be sealed lead acid gel/cell maintenance free types. The batteries shall have heavy duty, radial grids for mechanical strength with low grid corrosion rate and PVC plastic separators for low internal resistance. Batteries shall be sized as recommended by the manufacturer to supply the necessary DC power to the UPS system for the extended run time as required. The batteries shall be protected with a circuit breaker and the charger shall give a fault indication and shut down if an over voltage condition exists. The charger shall receive source power from the same AC line circuits as the UPS AC inputs. The complete system (batteries and UPS System) shall be furnished and guaranteed by the same manufacturer.
 - 3. The UPS Unit shall be of the Ferro-Resonant Transformer/Line Filtering type. All output power from the UPS will be conditioned by the Ferro-Resonant Transformer action. This conditioning will be in AC line mode or Inverter mode and is an integral function of Ferro-Resonant Transformer action.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- a. The unit shall have an indicator panel with the following alarms:
 - 1) AC Line – AC input power to the unit is present
 - 2) Ready – The UPS is operating normally and is ready to supply backup power from the battery during an outage.
 - 3) Charging – The UPS is charging the batteries.
 - 4) Battery Power – Input AC power problems have been detected. The UPS is supplying power to the protected equipment from the battery.
 - 5) Alarm – This is an alarm condition. The UPS will sound an audible alarm.
- b. The unit shall have an RS232 computer interface port that allows control and display of the meter and alarm conditions.

END OF SECTION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 28 SECURITY ELECTRONICS

Section 28 75 00 – ELECTRONIC CONTROL RELAY SYSTEM

PART 1 – GENERAL

1.01 Description

- A. The electronic control relay system will perform actual switching of power to locks, intercom, paging, etc. as required and shall be capable of interfacing with other systems. All relays shall be mounted in suitable enclosures with the capability of key lockable doors and removable steel mounting plate if required. The cabinets shall be sized as required to adequately accommodate the equipment housed therein and shall conform to the below requirements. The cabinets shall be installed as shown on contract drawings.

1.02 Acceptable Manufacturers

- A. Except as otherwise specified herein, the equipment and materials of this Section shall be products of the following manufacturers:
1. Montgomery Technology , Greenville, AL
 2. Cornerstone Detention, Huntsville, AL.
 3. Stanley Integrator, Noblesville, IN
 4. Unique Security Inc., Montgomery, AL

1.03 Construction

A. Class 1 Circuit Control Relays

1. The control relays shall be electro-mechanical type that are rated for at least 50% more current capacity than required for any given steady state control function, but in no case less than 10 amps for power control functions. The relays shall be capable of operating on an input signal of 24 VDC and the output shall be capable of switching the required voltage and current for the intended applications. The unit shall have a minimum of 2500 VAC isolation between the input and output.

B. Class 2 Circuit Control Relays

1. The control relays shall be electro-mechanical type that are rated for at least 50% more current capacity than required for any given steady state control function, but in no case less than 2 amps for power control functions. The relays shall be capable of operating on an input signal of 24 VDC and the output shall be capable of switching the required voltage and current for the intended applications. The unit shall have a minimum of 2500 VAC isolation between the input and output.

C. Control Relays

1. The control relays shall be optically isolated, zero crossing, solid-state type that are rated for at least 50% more current capacity than required for any given steady state control function, but in no case less than 10 amps for power control functions. The relays shall be capable of operating on an input signal of 24 VDC and the output shall be capable of switching the required voltage and current for the intended applications. The unit shall have a minimum of 2500 VAC isolation between the input and output.
2. The following requirements must be met for all locking control relays:
 - a. Each relay for locking control shall be individually fused to meet National Electric Code distribution requirements and to protect the relay and other circuitry from a short circuit failure at the lock.
3. Each relay rated at 4 amps or higher shall be socket mounted to facilitate field replacement.

- D. All relays and terminations are to be clearly labeled to show all field connections.

1.04 Wiring

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- A. All control wiring within the relay cabinets shall be installed using good workmanship and standard shop wiring and control practices. Conductors shall be grouped and laced with nylon tie straps. Straps will be placed on each side of all bundle breakouts.
 - B. Wiring will be supported at intervals not exceeding four inches and labeled at both ends. Each relay shall be labeled with its circuit number.
- 1.05 Line Voltage Wiring
- A. The wiring that extends from electronic control relay terminal strips to the 120 VAC locks, receptacles, etc. shall meet Article 300 of the National Electric Code. All power conductors shall be a minimum 14 AWG THHN or THWN, 600 volt rated and shall be installed in raceways and equipment enclosures with other conductors within limitations defined by Article 300 of the National Electric Code.
- 1.06 Class 2 Circuit Wiring
- A. The wiring that extends from the electronic control relay terminal strips to the low voltage devices shall be Class 2 as defined by article 725 of the National Electric Code. All control conductors shall be a minimum of 20 AWG, jacketed, control cable. All control cable insulation shall be 600 volt rated.
- 1.07 Wiring Standards
- A. All control wiring systems shall use stranded copper conductors. All terminations shall be made on Sems type terminal strips or shall be made with crimp type lugs correctly sized for terminations to none Sems type terminal strips and applied to conductor with crimping tool intended for use with the lug or connector used.
 - B. All wiring systems shall be labeled and color coded with labeling and coding shown on shop drawings. White conductors shall be used only for neutral conductors, green only for grounding conductors with exceptions of low voltage control wiring that meet the requirements of Article 725 of the National Electric Code. All conductors within junction boxes, pull boxes and equipment enclosures shall be groups and laced with nylon tie straps with identification tabs in individual sets, serving individual locks or groups. Conductor groups shall be identified on the tab with respect to room or area served. Control system conductors shall not be spliced. Control conductors shall be continuous between the control panel and the relay cabinet.

END OF SECTION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 28: EQUIPMENT

Section 28 79 00 - METAL BASE CABINETS, RACKS AND TURRETS

PART 1 – GENERAL

1.01 Drawings and any general provisions of the Contract for each Subcontract, including General and Supplementary Conditions and Construction Manager's specific requirements apply to this Section.

A. Description

1. The work required under this section of the specifications consists of the furnishing and installation of the equipment cabinets, consoles and housings necessary to contain the electronic equipment outlined in these specifications. The cabinets shall be installed in the locations shown on the contract drawings.

B. Acceptable Manufacturers

1. Except as otherwise specified herein, the equipment and materials of this Section shall be products of the following manufacturers:
 1. Middle Atlantic, Fairfield NJ
 2. Atlas-Soundolier, Parsippany, NY
 3. Hoffman Engineering Co., Anoka, MN

C. Construction

1. Free standing security equipment cabinets shall be constructed using good workmanship practices and methods and in accordance with the standards established for the metal casework industry. They shall be constructed of materials in size, thickness and type that are suitable for the final installation environment and the normal operating condition. Caseworks are to be manufactured with a suitable means of anchoring and/or affixing it to permanent plant structures. All caseworks should be of modular size to allow for ease of installation and must have suitable means of being joined to adjacent housing.
 2. Cabinet sizes shown on the drawings are based on design criteria and shall be modified as required to adequately accommodate the equipment to be installed therein. The cabinet sides shall be louvered 16-gauge sheet steel attached to 14 gauge 1.5 inches wide angle frames from the inside with bolts. The front of the cabinet shall have hinged lockable louvered doors and shall all be keyed alike. The rear of the cabinet shall have solid sheet steel unless the cabinet is mounted against a solid wall, in which case a back is not required. All trim, braces, angles, and exterior sides shall be primed and painted.
 3. All cabinets which house security equipment that requires periodic maintenance shall be supplied with hinged and lockable doors with pulls allowing easy and controlled access to the equipment. Doors shall be manufactured consistent with the supplied casework. All enclosures from the same manufacturer shall be keyed alike. Screw applied access panels shall be acceptable only at locations where room conditions will not allow hinged doors to properly open. All door hardware shall be standard products for their intended use.
 4. Cabinets are to be supplied with standard EIA mounting accessories to allow for the proper equipment mounting when appropriate. Where standard EIA mounting practices are not possible, the casework is to be of an appropriate style which is consistent with the type of equipment to be housed. Good workmanship practices shall be employed for the mounting of equipment in these instances.
- D. All special consoles and caseworks that are required for the project and are not obtainable as a standard manufactured product shall be designed and constructed in accordance with Item B above. Design drawings shall be included in the ESC submittal for architect approval of design and project acceptability.
- E. All metal cabinets are to be of standard manufacturer color unless otherwise specified by the architect prior to and/or during the submittal process.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- F. All writing surfaces and laminate counter tops are the responsibility of others unless explicitly noted otherwise on the contract drawings.

END OF SECTION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 28: SECURITY ELECTRONIC SYSTEM
Section 28 80 00 - UTILITY CONTROL INTERFACES

PART 1 – GENERAL

1.01 Description

A. Included in this Section of the Work shall be the furnishing, installation, connection and testing of the utility control interfaces for the facility.

1.1 GENERAL CONDITIONS:

A. General: The Conditions of the Contract (General, Supplementary and other Conditions) and the General Requirements (Sections of Division 1) are hereby made a part of this Section.

1.2 WORK EXCLUDED:

A. Division 26 (Electrical Contractor) shall be responsible for the lighting system and Low Voltage Termination Cabinets and relays.

1.3 RELATED WORK ELSEWHERE:

A. The work of this Section is related to the work of the following Divisions and Sections:
1. PLC System -
2. Security Control Stations - Touch Screen control stations
3. Locking Control System - Theory of Operation -
3. Division 23 – Mechanical Work
4. Division 26 – Electrical Work

1.4 COOPERATION WITH OTHER TRADES:

A. The Contractor shall coordinate the work of this Section with that of other Sections as required to ensure that the entire work of this Project will be carried out in an orderly, complete and coordinated fashion.
1. Coordinate with Division 26 for providing interface terminal blocks.

1.5 SUBMITTALS:

A. General: Submittals shall be made in accordance with the General Provisions (Section 28000) of these specifications.

B. Specific Requirements:

1. Submit catalog cut sheets for all equipment and devices furnished under this section.
2. Submit shop drawings showing mounting details for interface cabinets.

1.6 SYSTEM DESCRIPTION:

A. Cell lights, pod dayroom lights, dayroom TV power outlets and solenoid shower valves shall be controlled from the control stations. Division 26 shall provide Low Voltage Termination Cabinets (LVTC's) and LV Relays.

B. Division 28 shall extend control circuits from the SEC's to the LVTC's. Division 26 contractor to provide solenoid valves and low voltage relays for this contractor. See drawings for equipment locations and specific requirements. The following controls shall be interfaced to the Division 26 Low Voltage Termination Cabinets. The Div. 28 contractor is to provide low voltage wiring from dry contacts provided by others, to the SEC cabinets.

1. Cell Lighting:
a. Turn "On" or "OFF" cell lights on a group basis per housing unit.

2. Dayroom Lighting:
a. Dayroom lighting shall be two (2) lighting circuits per dayroom.

3. Power Control:
a. On/Off power shall be a single control per television outlet in inmate areas.

4. Shower valve control:
a. On/Off control of individual inmate showers inside dayrooms.

PART 2 - PRODUCTS

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2.1 MATERIALS:

- A. Low Voltage Termination Cabinet and LV Relays shall be furnished and installed by the Division 26 Contractor and located as shown on the drawings.
- B. Miscellaneous Hardware: ESC shall furnish and install miscellaneous hardware and materials as required to affect a complete and functional system up to and including interface to the LVTC.

PART 3 – EXECUTION

3.1 EXECUTION:

A. QUALITY ASSURANCE

- 1. Quality Assurance shall be as described in Section 28 40 00.

B. EXAMINATION

- 1. Verify that surfaces and areas are ready to receive work.
- 2. Verify that required utilities are available, in proper location, and ready for use.

C. INSTALLATION

- 1. Field testing and inspection will be performed under the provisions of Section 28 40 00.
- 2. Replace equipment, components, and wiring as required to achieve a fully functional system.

4. DEMONSTRATION, TRAINING, AND ACCEPTANCE, SPARE PARTS

- 1. Demonstration, training, and acceptance shall be as described in Section 28 40 00.
- 2. Spare Parts shall be as required in Security Electronic Control Section 28 40 00.

3.2 REQUIREMENTS

A. Interface Input and Outputs:

- 1. Provide outputs to the LVTC interface.

B. System Cabling:

- 1. Furnish all electrical cables between the LVTC and the Division 28 controls.
- 2. Division 28 shall be responsible for terminating the cabling to the Security Equipment cabinets.
- 3. Division 26 shall be responsible for furnishing and installing the conduits and raceways from the LVTC to the lighting relays.

C. Each control circuit furnished and installed by Division 28 shall be a three (3) wire control circuit. A single control circuit may control multiple relays.

D. Terminal Labeling: All terminals provided as output points to the lighting and power On/Off controls shall be clearly labeled for termination by the Division 26 contractor.

3.2 COMPLETION:

- A. General: Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and the like and leave the premises clean, neat and orderly.
- B. Testing: The completed system shall be tested prior to acceptance testing by the Owner or Owner's representative.

END OF SECTION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 28 SECURITY ELECTRONICS

Section 28 85 00 – LIGHTNING/SURGE SUPPRESSION

PART 1 – GENERAL

1.01 DESCRIPTION

- A. The work required under this section of the specifications requires the furnishing and installation of Transient voltage Surge Suppression (TVSS) devices for the protection of electrical systems, communication and data lines. TVSS devices shall protect all A/C and D/C circuits from the effects of lightning induced over voltages, internally generated transient and utility switching transients. Catalog numbers have been taken from Northern Technologies, Inc., and are specified to set a standard for quality.
- B. Acceptable Manufacturers : Acceptable Manufacturers Except as otherwise specified herein, the equipment and materials of this Section shall be products of the following manufacturers:
 - 1. Northern Technologies, Inc., Spokane, WA
 - 2. Transtector Systems, Hayden Lake, ID
 - 3. Schneider Electric, Albany, NY

1.02 TVSS Technology – AC Power Applications

- A. The primary suppression path shall be pure Silicon Avalanche Diodes (SAD). TVSS device shall incorporate a primary suppression system and a secondary suppression system.
- B. Silicon Avalanche Diodes must be bipolar, of grade A, +/-5% tolerance and meet the Defense Electronics Supply Center (DESC), specification requirements.
- C. TVSS devices shall provide “power-on” and “failure” indication lights. An optional remote status capability for indication of primary suppression path failure shall be available.
- D. TVSS devices shall be UL listed and bear the UL label on each product. All TVSS devices shall be tested in accordance with the ANSI/IEEE Testing Standard, C62.45.
- E. Gas tubes, Selenium plates, M.O.V. or Hybrid type suppressors will not be accepted.
- F. AC power protection units shall be Northern Technologies TCS-HW or approved equal.
- G. If a U.P.S. is provided, then the TVSS must be placed in front of the U.P.S.

1.03 TVSS Technology – DC Applications – Twisted Pairs, Coaxial Lines

- A. The primary suppression path shall be pure Silicon Avalanche Diodes (SAD).
- B. Silicon Avalanche Diodes must be bipolar, of grade A, +/-5% tolerance and meet the
- C. Defense Electronics Supply Center (DESC) specification requirements.
- D. TVSS devices shall operate in a parallel to the circuit, not employing switching components and have no series resistance.
- E. TVSS devices shall provide a minimum of 5 joules of SAD's per line, not per device.
- F. Gas tubes, selenium plates, M.O.V., or hybrid type suppressors will not be accepted.
- G. Coaxial Transient Suppressor: TCS-CP-1 or approved equal.
- H. Data Lines Suppressor: DLP-41, 42, 43, 44, 45 or approved equal. Signal line voltage must be determined prior to installation.

1.04 Quality Assurance

- A. TVSS manufacturer shall be ISO 9001 certified by an accredited certification organization and ANSI-RAB.

2.0 Execution

- A. Install TVSS devices on all AC, data and communication lines to protect against surges induced on all control lines, sensors, data lines and cables that enter and exit building(s).

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. Data and communication protection devices shall be mounted in a NEMA 1 enclosure with all wiring in the enclosure to be kept in plastic wiring troughs. The incoming cables shall be kept separate from the outgoing cables. There shall be a ground buss in the lower corner of the enclosure and shall be sized to accept a #6 BCW. The Bare Copper Wire shall be terminated to the nearest ground rod system. See Division 16.
- C. AC protection devices can be located in the equipment cabinet and must be placed before any distribution (i.e., multi-outlets) can be utilized. Grounding shall be the same as indicated in the data and communication specification preceding.

END OF SECTION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 28: SECURITY ELECTRONIC SYSTEM
Section 28 90 00: SECURITY MANAGEMENT SERVER

PART 1 – GENERAL

1.0 System Overview Description

- A. The purpose of this project is to form a facility-wide, completely integrated PLC based security solution.

1.1 SUMMARY

- A. This section includes the requirements and operational characteristics for Security Management Server System comprised of the following equipment that is 100% integrated with the Security Automation System.
- B. Related Sections: The following sections contain requirements that relate to this section:
1. Division 26 Section "Basic Electrical Requirements."
 2. Division 28: All sections of the "Security Electronic Control System"

1.2 SYSTEM DESCRIPTION

- A. The SMS data recording engine shall log security commands made within the detention facility as they happen. Provide facility administrators the ability to monitor and review all operational aspects of the Security Automation System and its operations. The intent is that by recording all actions of the system, it shall provide owners with greater liability protection and accountability.

1.3 SOFTWARE REQUIREMENTS

- A. The Security Management Server (SMS) System shall have the following software requirements to allow for seamless control and future flexibility.
- B. Data Logging:
1. The integrator shall provide a SMS system with a single point for logging, recording, report generation and backup. Distributed databases are not acceptable.
 2. The SMS shall be capable of processing 100,000 transactions per day (minimum).
 3. The SMS shall be capable of communication to multiple PLC's over Ethernet.

PART 2 - PRODUCTS

2.1 SYSTEM FEATURES

- A. The Security Management Server (SMS) performs several valuable functions, but is not an essential component of any operational control system. It shall be configured as follows:
1. The SMS is an IBM type personal computer connected via Ethernet to the PLC controller.
 2. The SMS receives alarm and transactions from the PLC within 500 milliseconds of the occurrence. The SMS shall record Time/Date, Device, Device Action, and user the name of the user performing the action for all transactions and alarms. Transactions & Alarms include, but are not limited to:
 - a. The SMS shall record to disk all door openings, closings, unlocking, re-locking, secure actions, door position, lock status, violations, violation silencing, violation resetting, interlock violations, and resetting of interlock violations.
 - b. ISOLATED doors are reported by the SMS during daily reports. Changing the state of ISOLATED doors is recorded to disk by the SMS.
 - c. Doors with LOCAL ACCESS granted are reported by the SMS during daily reports. Changing the state of LOCAL ACCESS doors is recorded to disk by the SMS.
 - d. All interlock override activities.
 - e. All Misc. system functions.
 - f. All transactions of the watchtour(s) and provide a daily report of all tours.
 - g. All utilities activities.
 - h. All PLC system faults.
 - i. All login/logout activities.
 - j. All Occurrence Log transactions.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. All transactions (action codes), alarms and status are continually outputted from the PLC. The PLC shall be able to service this data management activity and continually control all other devices specified elsewhere in this specification without any additional delay in system throughput.
 4. The SMS will provide preventative maintenance functions by continually counting operations of all devices.
- B. The SMS operates in a MICROSOFT WINDOWS environment and provides the following features:
1. The SMS shall be capable of recording all events of all stations and panels.
 2. Transactions sent to screen, disk or printer are time and date stamped. Line by line printing shall contain line numbers, such that physical cutting and pasting is impossible. Any printed reports shall also contain this protection.
 3. Provide password protection to prevent modifications to the database system.
 4. All reports/searches shall take less than five minutes to generate for the most intensive retrieval.
 5. The database shall be able to contain up to 5 million transactions prior to the need to archive data. The system shall allow the user to perform backups in 600MB sections to facilitate backup to CD-RW. Archived data shall be viewable, in an identical format as the original SMS, from the CD without the need to install any additional software. All data on the CD shall be able to be sorted, searched, reports generated and printed directly from the CD.
 6. The system shall notify the user when the transaction register is 85% of the maximum to allow for data archival. If the database reaches it maximum, logging will not be affected. Instead, an automated deletion of the oldest 600MB of data will be purged to allow new data to be saved.
 7. The database reports shall include the option to export the data to a comma separated file (.csv) to be used by owner provided software.
- C. The SMS will include a complete comprehensive relational database report utility, accessible via a pull down menu. All reports are titled, time and data stamped, and contain anti-cut and paste line numbering. It shall be possible to easily select report to show the history of any device or group of devices between specified times and dates
1. The DAILY REPORT will print to screen or paper the list of states during the day by event occurrence of all controlled devices, alarms, isolations and conditions. The report is programmable to the desires of the owner. Consultation with the owner during the training period will determine the content of this report.
 2. The HISTORICAL REPORT allows the operator to select any and all transaction types, alarms, watchtour, time changes and any other system functions as described in the specifications, and is done by defining a start date and time and a stop date and time. The computer will search any applicable matching occurrences and print either to the screen or printer as a report; thus allowing searching for:
 - a. Specific time periods
 - b. Specific transaction types
 - c. Specific locations
 - d. Any combination of the above
 - e. Specific keywords
- D. SMS Client:
1. Provide the ability for clients to backup/archive the event log database, to view data from any archived database, including CD-ROMs, and export reports to a .csv format.
 2. Provide ability to add, delete, and modify users for the login validation.
 3. Provide the ability to assign users access to specific control stations.
 4. Provide a fully integrated, Windows based, on-line help system.
 5. Provide a fully integrated Web based client, which shall allow access to the SMS database, through password protection, via a commercially available browser application. The Web based client shall allow the viewing of all transactions, generate all reports, allow searches and printing to local printers.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

2.2 EQUIPMENT AND MATERIALS

A. Hardware configuration

1. Computer shall have the following features:

- a. Pentium Core i 7, 3.4 GHz processor, minimum
- b. 2048 MB RAM capacity (minimum).
- c. Configured with a minimum of 8 GB of RAM.
- d. Hard Drives:
 - (1) Standard Terminals - Minimum 500 GB, 7200 RPM hard drive with maximum 9 msec access time.
 - (2) Main Terminals - Minimum three (3) 36 GB hot swappable, self-restoring, SCSI or IDE hard drives in RAID 5 configuration. If any of the hard drives fail during system use, the controller shall initiate an audible alarm or similar to alert the maintenance technicians to the failure.
- e. Internal DVD RW/DVD+R Double Layer Drive with disk imaging software Symantec Ghost, Acronis True Image or approved equal.
- f. Furnished with a 27" LED monitor, keyboard, mouse and laser printer.
- g. Furnished with communications, video, and audio cards as required.
- h. Shall be mounted in the console base.
- i. Shall be powered by a UPS.
- j. Shall contain a sound card and amplified speaker for special audio effects.
- k. Virus protection software.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces and areas are ready to receive work.
- B. Verify field measurements are as shown on Drawings and as instructed by manufacturer.
- C. Verify that required utilities are available, in proper location, and ready for use.

3.2 INSTALLATION

- A. Field testing and inspection shall be as described in Section 28 40 00.
- B. Replace equipment, components, & wiring as required to achieve a fully functional system.

3.3 DEMONSTRATION, TRAINING, ACCEPTANCE

- A. Demonstration, training, and acceptance shall be as described in Section 28 40 00.

END OF SECTION

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

**SECTION 31 00 00
EARTHWORK**

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Preparing of subgrade and grading for buildings, slabs, walks, embankments, slopes and pavements.
 - 2. Excavating and backfilling of utility trenches.
- B. Related Documents
 - 1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO R 18 – Establishing and Implementing a Quality System for Construction Materials Testing Laboratories.
- B. ASTM International:
 - 1. ASTM D 698 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 2. ASTM D 1556 – Standard Test Method for Density and Unit Weight of Soil in place by the Sand-Cone Method
 - 3. ASTM D 1557 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - 4. ASTM D 2487 – Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 - 5. ASTM D 2922 – Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (shallow depth).
 - 6. ASTM D 2937 – Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method
 - 7. ASTM D 3017 – Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (shallow depth).
 - 8. ASTM D 4318 – Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils
 - 9. ASTM D 4959 – Standard Test Method for Determination of Water (Moisture) Content of Soil by Direct Heating.
 - 10. ASTM D 6913 Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
 - 11. ASTM D 7830 Standard Test Method for In-Place Density and Water Content of Soil Using an Electromagnetic Soil Density Gauge

1.3 DEFINITIONS

- A. Excavation: Removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

- B. Unauthorized excavation: Removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer. Unauthorized excavation, as well as remedial work directed by the Engineer, shall be at the Contractor's expense.
 - 1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Engineer.
 - 2. In locations other than those above, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by the Engineer.
- C. Additional Excavation: When excavation has reached required subgrade elevations, notify Engineer, who will evaluate conditions. If Engineer determines that bearing materials at required subgrade are unstable, continue excavation until suitable bearing materials are encountered and replace excavated material as directed by Engineer. The Contract Sum may be adjusted by an appropriate Contract Modification.
 - 1. Removal of unsuitable material and its replacement as directed will be paid on basis of Conditions of the Contract relative to changes in work.
- D. Subgrade: The undisturbed soil or rock, or the compacted fill layer immediately below structures, granular base, drainage fill, or topsoil materials.
- E. Structures: Buildings, foundations, slabs, tanks, pavements, gravel drives or road, walks, curbs, cut slopes, fill embankments, utilities, or other man-made stationary features occurring above or below ground surface.
- F. Structural Areas: Those plan locations containing a structure plus a minimum of 5 feet beyond the outside edge of the structure including appurtenances or as defined elsewhere in the project documents.
- G. Structural Fill: Materials placed as fill in Structural Areas.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures.
- B. Materials Source: Submit name of imported materials source.
- C. Test Reports: All test reports must be completed under the supervision of a registered engineer, licensed in the state in which the project is located. Contractor will notify testing agency a minimum of 24 hours prior to performing work that requires testing. Submit the following test reports directly to Engineer, with copy to Contractor:
 - 1. Test reports on borrow material. (ASTM D-2487, 4318, 6913)
 - 2. Verification of each foundation bearing surface in accordance with specified requirements.
 - 3. Field reports of in-place density tests.
 - 4. One optimum moisture-maximum density curve for each type of soil encountered. (ASTM D-698 or ASTM D-1557)
 - 5. Subgrade evaluation report for all structural areas prior to fill placement and after establishing final subgrade, but prior to pavement or building slab construction.

*CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA*

1.5 QUALITY ASSURANCE

- A. Borrowed material must come from single approved source throughout the Work.
- B. Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.
- C. Testing and Inspection Service: Owner will employ and pay for a qualified independent geotechnical testing and inspection laboratory in accordance with Section 01 20 00 to perform soil testing and inspection service during earthwork operations. Laboratory shall be selected by the Engineer.
- D. Testing Laboratory Qualifications: To qualify for acceptance, the geotechnical testing laboratory must demonstrate to Engineer's satisfaction, based on evaluation of laboratory submitted criteria conforming to AASHTO R18, that it has the experience and capability to conduct the required field and laboratory geotechnical testing.

1.6 PROJECT CONDITIONS

- A. Site Information: Data in subsurface investigation reports (if performed) was used for the basis of the design and are available to the Contractor for information only. Conditions noted in the report(s) are not intended as representations or warranties of accuracy or continuity between soil borings. The Owner and Engineer will not be responsible for interpretations or conclusions drawn from this data by Contractor.
 - 1. Additional test borings and other exploratory operations may be performed by Contractor, at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.
- B. Existing Utilities: Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.
 - 1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner at no expense to the Owner.
 - 2. Do not interrupt existing utilities serving facilities occupied by Owner or others during occupied hours, except when permitted in writing by Engineer and then only after acceptable temporary utility services have been provided.
 - a. Provide minimum of 48-hour notice to Engineer and receive written notice to proceed before interrupting any utility.
 - 3. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shutoff of services if lines are active. Resultant excavations must be backfilled in lifts and tested in accordance with the project requirements.

CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- C. Use of Explosives: Use of explosives is not permitted.
- D. Jobsite safety and conformance to applicable codes and guidelines to protect persons and property is solely the responsibility of the contractor.
 - 1. Excavate in accordance with OSHA guidelines. Barricade open excavations.
 - 2. Operate safety barriers, markings and warning lights as required to maintain a safe work environment and as recommended by authorities having jurisdiction.
 - 3. Protect structures, utilities, sidewalks, pavements, and other facilities to remain from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
 - 4. Perform excavation by hand within dripline of large trees to remain. Protect root systems from damage or dryout to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with moistened burlap.

PART 2 PRODUCTS

- A. Base Material: Naturally or artificially graded mixture of crushed gravel or stone, sand or select granular materials conforming to the Department of Transportation requirements for the state in which the project is located.
- B. Aggregate: Graded fine or coarse aggregates as specified in Section 31 05 17.
- C. Structural Fill: On or off-site soil free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. Material shall have a liquid limit of 50 or less, a plasticity index of 25 or less, less than 20% rock fragments retained on a 3/4" sieve, and a maximum dry density of at least 100 pcf. May also consist of Aggregate Type A2, Type A3 or Crushed Aggregate Base Course.
- B. General Fill: On or off-site soil and/or rock which is stable and can be compacted to the specified density. Rock fragments shall be less than 4 inches in largest dimension and blended with sufficient fines to create a dense fill mass free of visible voids.

PART 3 EXECUTION

3.1 EXCAVATION

- A. Excavate topsoil from areas designated. Strip topsoil to full depth of topsoil in designated areas as directed by the Engineer.
- B. Stockpile excavated material meeting requirements for satisfactory soil materials and topsoil materials.
- C. Remove excess excavated material not intended for reuse from site.
- D. Excavate to subgrade elevations or cut line as indicated, regardless of character of materials and obstructions encountered, including rock, existing structures, and utilities. Subsurface materials are unclassified.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

3.2 STABILITY OF EXCAVATIONS

- A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction. Design of retaining structures must be performed, signed and sealed by a registered engineer licensed in the state in which the project is located.
- B. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.
- C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses.
 - 1. Provide permanent steel sheet piling or reinforced concrete drilled shaft walls wherever subsequent removal of retaining structure might permit lateral movement of soil under adjacent structures. Cut off tops a minimum of 2'-6" below final grade and leave permanently in place.

3.3 DEWATERING

- A. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
 - 1. Do not allow water to accumulate in excavations or in foundation excavations prior to or following footing construction. Remove water to prevent softening of foundation boring soils, undercutting footings, and soil changes detrimental to stability of the subgrade and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
 - 2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rainwater and water removed from excavations to collecting or runoff areas. Do not use trench excavations as temporary drainage ditches.
 - 3. Dewater excavations only as necessary for suitable construction. Do not continue dewatering overnight or for an extended period of time except as required.

3.4 STORAGE OF EXCAVATED MATERIALS

- A. Stockpile excavated materials acceptable for backfill and fill where directed. Place, grade, and shape stockpiles for proper drainage. Stabilize in accordance with ADEM and NPDES regulations.
 - 1. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.
 - 2. Dispose of excess excavated soil material and materials not acceptable for reuse as backfill or fill.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

3.5 EXCAVATION FOR STRUCTURES

- A. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, and other construction and for inspection.
 - 1. Excavations for footings and foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim sides and bottom to required lines and grades. Compact with hand or remote operated equipment to leave solid base to receive other work.
 - 2. For pile foundations, stop excavations from 6 inches to 12 inches above bottom of cap before piles are placed. After piles have been placed, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
 - 3. Excavations for soil supported foundations must be neat, clean and dry. Remove loose, disturbed and soft soil. Dewater only as necessary for proper construction.

3.6 EXCAVATION FOR PAVEMENTS

- A. Cut surface under pavements to comply with cross-sections, elevations and grades as indicated.

3.7 TRENCH EXCAVATION FOR PIPES AND CONDUIT

- A. Excavate trenches to uniform width, sufficiently wide to provide ample working room and a minimum of 36 inches total width.
- B. Excavate trenches and conduit to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on structural fill or undisturbed soil and bedding material. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
 - 1. Where rock is encountered, refer to Section 31 10 00. No direct payment will be made for rock removal, unless specified in other sections.
 - 2. For pipes or conduit in all other soil conditions, refer to Section 31 23 33 – Trenching and Backfilling.

3.8 COLD WEATHER PROTECTION

- A. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.
- B. Do not place frozen soil fill.

3.9 BACKFILL AND FILL

- A. General: Place soil material in uniform, horizontal lifts as required to final subgrade elevations. Compact individual lifts uniformly to specified density prior to placing the subsequent lift. For each area classification listed below, use materials specified in Part 2

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

of the Section.

1. In non-structural areas, use general fill. The final lift shall be the required thickness of topsoil.
 2. In structural areas, use structural fill or aggregate. The final lift shall be as indicated on the plans.
 3. Under utilities, use aggregate as indicated on the plans in areas determined by the Engineer to be unsuitable for pipe bedding. Shape excavation bottom to fit bottom 90 degrees of cylinder.
 4. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings or that are carried below bottom of such footings or that pass under wall footings. Place concrete to level of bottom of adjacent footing.
 - a. Concrete is specified in Section 03 30 00.
 - b. Do not backfill trenches until tests and inspections have been made and backfilling is authorized by Engineer. Use care in backfilling to avoid damage or displacement of pipe systems.
 5. Provide 4-inch-thick concrete base slab support for piping or conduit less than 24" below surface of roadways. After installation and testing of piping or conduit, provide minimum 4-inch-thick encasement (sides and top) of concrete prior to backfilling or placement of roadway base.
- B. Backfill excavations as promptly as work permits, but not until completion of the following:
1. Acceptance of construction below finish grade including, where applicable, damp proofing, waterproofing, and perimeter insulation.
 2. Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded.
 3. Removal of concrete formwork.
 4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities or leave in place if required.
 5. Removal of trash and debris from excavation.
 6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

3.10 PLACEMENT AND COMPACTION

- A. Ground Surface Preparation: Remove vegetation, debris, topsoil, obstructions, underground structures (foundations, slabs, walls and utilities), and deleterious materials from area prior to placement of fills. Backfill disturbed areas with compacted and tested fill. Contractor shall notify Engineer to evaluate the natural ground prior to fill placement. Where access permits, Contractor shall provide pneumatic-tired equipment capable of producing the pressure equal to that produced by a fully loaded, tri-axle dump truck for use in evaluation.
1. When existing ground exhibits instability, scarify ground surface, moisture-condition to within 2% of the optimum moisture content, and compact to the project requirements. Alternatively, remove and replace unstable soils with

CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- suitable, compacted soils or stabilize at the direction of the Engineer.
2. Bench sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface. Benches shall consist of alternating horizontal and vertical soil surfaces in the original ground with horizontal benches no more than 5 feet apart vertically.
 3. Overbuild slopes and cut back to the desired configuration to ensure the soils at the slope face are properly compacted and tested.
- B. In structural areas, place structural fill or aggregate in layers not more than 8 inches in loose thickness for material compacted by heavy compaction equipment, and not more than 4 inches in loose thickness for material compacted by hand-operated tampers. In non-structural areas, place general fill in maximum 24" thick lifts.
- C. In structural areas, before compaction, moisten or aerate each layer of fill as necessary to provide moisture content within the fill at $\pm 2\%$ of the optimum moisture content. Compact each layer to required percentage of maximum dry density for each area classification. Do not place structural fill on surfaces that are muddy, frozen, or contain frost or ice.
- D. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.
- E. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by Engineer if soil density tests indicate inadequate compaction.
1. Percentage of Maximum Standard Proctor Density Requirements:
 - a. Structural Areas: Compact each individual lift of structural fill and fine aggregate to not less than 98% of the maximum standard Proctor density in accordance with ASTM D-698. Compact each individual lift of coarse aggregate using multiple passes of a vibratory compactor or as directed by the Engineer.
 - b. Non-Structural Areas: Compact each individual lift using multiple passes of a compactor designed for the type of soils used as fill or backfill.
 2. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.
 - a. Remove and replace or scarify and air dry soil material that is too wet to permit compaction to specified density.
 - b. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

3.11 GRADING

- A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition area. Smooth finished surface within specified tolerances, compact with

CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

uniform levels or slopes between points where elevations are indicated or between such points and existing grades.

- B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes and as follows:
 - 1. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.
 - 2. Walks: Shape surface of areas under walks to line, grade, and cross-section, with finish surface not more than 0.10 foot above or below required subgrade elevation.
 - 3. Pavements: Shape surface of areas under pavement to line, grade, and cross-section, with finish surface not more than ½ inch above or below required subgrade elevation.
- C. Grading Surface of Fill under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of ½ inch.
- D. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

3.12 PAVEMENT BASE COURSE

- A. General: Base course consists of placing base material in layers of specified thickness, over subgrade surface to support a pavement base course.
 - 1. Refer to other Division 2 sections for paving specifications.
- B. Grade Control: During construction, maintain lines and grades including crown and cross-slope of base course.
- C. Shoulders: Place shoulders along edges of base course to prevent lateral movement. Construct shoulders of acceptable soil materials placed in such quantity to compact to thickness of each base course layer. Compact and roll at least a 12-inch width of shoulder simultaneous with the compaction and rolling of each layer of base course.
- D. Placing: Place base course material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting base material during placement operations.
 - 1. When a compacted base course is indicated to be 6 inches thick or less, place material in a single layer. When indicated to be more than 6 inches thick, place material in equal layers, except no single layer more than 6 inches or less than 3 inches when compacted.
 - 2. Compact individual lifts of the base to a minimum of 100% of the ASTM D-1557 maximum dry density at ±2% of the optimum moisture content.

3.13 BUILDING SLAB DRAINAGE COURSE

- A. General: Drainage course consists of placing aggregate in layers of indicated thickness over subgrade surface to support concrete building slabs.

*CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA*

- B. Placing: Place aggregate on prepared subgrade in layers of uniform thickness, conforming to the indicated cross-section and thickness. Maintain optimum moisture content for compacting material during placement operations.
 - 1. When a compacted drainage course is indicated to be 6 inches thick or less, place material in a single layer. When indicated to be more than 6 inches thick, place material in equal layers, except no single layer shall be more than 6 inches or less than 3 inches when compacted.
 - 2. Compact the individual lifts of the drainage course with a vibratory compactor as directed by the Engineer.

3.14 FIELD QUALITY CONTROL

- A. Quality Assurance consisting of testing and observation of a limited sampling shall be performed at the owner's expense. Passing test results are not a warranty, guarantee, or certification by the testing agency, Engineer, or Owner that all work was performed in conformance with the plans and specifications. Therefore, the Contractor should not rely solely on test results generated by the quality assurance process as an indication of the suitability of the construction.
- B. It is entirely the Contractor's responsibility to perform quality control as necessary to construct the project in conformance with the plans and specifications. Deviations from the plans and specifications, whether identified during construction or following the completion of construction, must be corrected by the Contractor at no cost to the Owner.
- C. Quality Control Testing During Construction: Allow owners testing service to test each subgrade and fill layer before further backfill or construction work is performed.
 - 1. Perform field density tests on each lift of fill in accordance with ASTM D 2937 (Drive Cylinder Method), ASTM D 2922 (Nuclear Method), ASTM D 7830 (Electromagnetic Method), or ASTM D 1556 (sand cone method).
 - a. In conjunction with each density test, the natural moisture content shall be determined in accordance with ASTM D 3017 (nuclear method), ASTM D 4959 (direct heating), ASTM D 7830 (electromagnetic method) or other method approved by the Engineer.
 - b. If field tests are performed using nuclear or electromagnetic methods, make calibration checks using alternate methods of both density and moisture results on each different type of material encountered and at intervals as directed by the Engineer.
 - 2. Footing Subgrade: For all soil on which footings will be placed, perform tests to verify required design bearing capacities. Engineer shall be notified to observe and approve each footing subgrade. Engineering evaluation may include the excavation of hand augers or test pits. The contractor shall provide suitable equipment to excavate test pits as directed by the Engineer.
 - 3. Paved Areas and Building Slab Subgrade: Perform at least one field density test per lift for every 2,500 sq. ft. of area, but in no case fewer than three tests.
 - 4. Foundation Wall Backfill: Perform at least two field density tests on each lift of fill placed at locations directed by the Engineer.

*CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA*

- D. If in opinion of Engineer, based on testing reports or Engineering judgement, subgrade or fill that have been placed are unsuitable, perform additional compaction and testing until specified density is obtained. Do not place additional fill over materials that have not been approved by the Engineer. Work to recompact and retest unsuitable areas will be at the expense of the contractor.

3.15 EROSION CONTROL

- A. Provide erosion control methods in accordance with requirements of authorities having jurisdiction and/or as described in the Plans.
- B. Unless otherwise specified in the Plans, the contractor is responsible to apply for and obtain any required permits in the contractor's name associated with current NPDES guidelines. The application process shall be coordinated with CDG Engineers & Associates. Requirements for implementing and maintaining an acceptable Best Management Practices Plan shall be the responsibility of the contractor. The contractor is responsible to maintain the NPDES permit in good standing with the regulatory authority and comply with applicable NPDES regulations during construction and terminate permit upon completion and approval at no additional cost to the owner.

3.16 MAINTENANCE

- A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.
- C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.
- D. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work and eliminate evidence of restoration to greatest extent possible.

3.17 DISPOSAL OF EXCESS AND WASTE MATERIALS

- A. Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash, and debris, and dispose of it off Owner's property.
 - 1. Secure a disposal site and all necessary approvals for use.
 - 2. Remove excess excavated material, trash, debris, and waste materials and dispose of it off Owner's property.
 - 3. Excavated material in area noted on plans shall be screened by geotechnical engineer. If classified "contaminated", it shall be stockpiled and monitored by the contractor at no additional cost.

END OF SECTION

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

**SECTION 31 05 17
AGGREGATE MATERIALS**

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Coarse aggregate materials.
 - 2. Fine aggregate materials.
- B. Related Sections:
 - 1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO M147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.
 - 2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. ASTM International:
 - 1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m<sup>3 - 3. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft³ (2,700 kN-m/m<sup>3 - 4. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 - 5. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.</sup></sup>

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures.
- B. Samples: Submit 10-gallon sample of each type of aggregate to testing laboratory.
- C. Materials Source: Submit name of imported materials suppliers.
- D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Furnish each aggregate material from single source throughout the Work.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
 MENTAL HEALTH / MEDICAL UNIT
 ANNISTON, ALABAMA**

PART 2 PRODUCTS

2.1 COARSE AGGREGATE MATERIALS

- A. Coarse aggregate shall consist of crushed gravel or stone having hard, strong, durable pieces, free from adherent coatings.
- B. Coarse Aggregate Type A1 (ALDOT Aggregate size No. 4) shall be graded in accordance with the following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
2 inches	100
1-1/2 inch	90 to 100
1 inch	20 to 55
3/4 inch	0 to 15
1/2 inch	-----
3/8 inch	0 to 5
No. 4	-----
No. 8	-----
No. 16	-----
No. 50	-----
No. 200	-----

- C. Coarse Aggregate Type A2 (ALDOT Aggregate size No. 57) shall be graded in accordance with the following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
2 inches	-----
1-1/2 inch	100
1 inch	95 to 100
3/4 inch	-----
1/2 inch	25 to 60
3/8 inch	-----
No. 4	0 to 10
No. 8	0 to 5
No. 16	-----
No. 50	-----
No. 200	-----

- D. Coarse Aggregate Type A3 (ALDOT Aggregate size No. 78) shall be graded in accordance with the following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
2 inches	----
1-1/2 inch	----
1 inch	----
3/4 inch	100
1/2 inch	90 to 100
3/8 inch	40 to 75
No. 4	5 to 25
No. 8	0 to 10
No. 16	0 to 5

2.2 FINE AGGREGATE MATERIALS

- A. Fine Aggregate Type A4 (Concrete Sand): Washed sand; free of loam, friable or soluble materials, and organic matter; non-plastic; graded in accordance with ASTM C136; within the following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
3/8 inch	100
No. 4	95 to 100
No. 8	80 to 100
No. 16	50 to 90
No. 50	5 to 30
No. 100	0 to 10

- B. Fine Aggregate Type A5 (Natural Sand): Natural sand; free of loam, friable or soluble materials, and organic matter; non-plastic; graded in accordance with ASTM C136; within the following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
3/8 inch	100
No. 4	95 to 100
No. 8	----
No. 16	50 to 80
No. 50	20 to 50
No. 100	10 to 25
No. 200	5 to 12

2.3 SOURCE QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements.
- B. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698, ASTM D1557, ASTM D4318, or ASTM C136.

- C. Fine Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698, ASTM D1557, ASTM D4318, or ASTM C136.
- D. When tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.1 EXCAVATION

- A. Excavate aggregate materials from on-site locations as specified in Section 31 00 00.
- B. Stockpile excavated material meeting requirements for coarse aggregate materials and fine aggregate materials.
- C. Remove excess excavated materials not intended for reuse, from site.
- D. Remove excavated materials not meeting requirements for coarse aggregate materials and fine aggregate materials from site.

3.2 STOCKPILING

- A. Stockpile materials on site.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.
- D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.
- E. Stockpile unsuitable materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

**SECTION 31 10 00
SITE CLEARING**

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Removing surface debris.
 - 2. Removing designated paving, curbs, and culverts.
 - 3. Removing designated trees, shrubs, and other plant life.
 - 4. Removing abandoned utilities.
 - 5. Excavating topsoil.
- B. Related Sections:
 - 1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures.
- B. Product Data: Submit data for herbicide. Indicate compliance with applicable codes for environmental protection.

1.3 QUALITY ASSURANCE

- A. Conform to applicable codes for environmental requirements, disposal of debris, burning debris on site, use of herbicides, and disposal of sludge.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements.
- B. Verify existing plant life designated to remain is tagged or identified.

3.2 PREPARATION

- A. Call Alabama One Call service at 1-800-292-8525 or 811 not less than three working days before performing Work.

*CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA*

1. Request underground utilities to be located and marked within and surrounding construction areas.

3.3 PROTECTION

- A. Locate, identify, and protect utilities indicated to remain, from damage.
- B. Protect trees, plant growth, and features designated to remain.
- C. Protect bench marks, survey control points, and existing structures from damage or displacement.

3.4 CLEARING

- A. Clear areas required for access to site and execution of Work to minimum depth of 12 inches.
- B. Remove trees and shrubs within indicated areas. Remove stumps, surface rock, and fences.
- C. Clear undergrowth and deadwood, without disturbing subsoil.
- D. Apply herbicide to remaining stumps to inhibit growth.

3.5 REMOVAL

- A. Remove debris, rock, and extracted plant life from site.
- B. Partially remove paving, curbs, and gutters. Neatly saw cut edges at right angle to surface.
- C. Remove abandoned utilities. Indicated removal termination point for underground utilities on Record Documents.
- D. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.
- E. Do not burn or bury materials on site. Leave site in clean condition.

3.6 TOPSOIL EXCAVATION

- A. Excavate topsoil from areas to be further excavated, relandscaped, or regraded, without mixing with foreign materials for use in finish grading.
- B. Do not excavate wet topsoil.
- C. Stockpile in area designated on site to depth not exceeding 8 feet and protect from erosion. Stockpile material on impervious material until disposal.
- D. Remove excess topsoil not intended for reuse, from site.

*CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA*

3.7 SITE RESTORATION

- A. Restore all areas disturbed by the construction activities to pre-construction conditions or better.
- B. Restore areas to satisfaction of Owner and Land Owner if work has occurred on private property.
- C. If preconstruction documentation of existing conditions has not been performed, restore areas to complete satisfaction of Owner and Land Owner at no additional cost to Owner.
- D. Restore paved or unpaved streets, roads, sidewalks, curbs, etc. disturbed by the construction activities to preconstruction conditions or better using materials and workmanship conforming to requirements of Owner, City or Alabama Department of Transportation, whichever applies.
- E. Maintain seeded areas and re-seed as needed until a stand of grass satisfactory to the Owner is established.

END OF SECTION

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

**SECTION 31 23 33
TRENCHING AND BACKFILLING**

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Excavating trenches for utilities.
 - 2. Backfilling and compaction.
- B. Related Sections:
 - 1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. ASTM International:
 - 1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 3. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
 - 4. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - 5. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
 - 6. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 7. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 DEFINITIONS

- A. Utility: Any buried pipe, duct, conduit, or cable.
- B. Structures: Buildings, foundations, slabs, tanks, pavements, walks, curbs, cut slopes, fill embankments, utilities, or other man-made stationary features occurring above or below ground surface.
- C. Structural Areas: Those plan locations containing a structure plus a minimum of 5 feet beyond the outside edge of the structure including appurtenances or as defined elsewhere in the project documents.
- D. Structural Fill: Materials placed as fill in Structural Areas.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

1.4 SUBMITTALS

- A. Product Data: Submit data for geotextile fabric indicating fabric and construction.
- B. Materials Source: Submit name of imported fill materials suppliers.

1.5 QUALIFICATIONS

- A. Prepare erosion control plan and submit to Engineer prior to start of construction.
- B. Refer to Section 31 25 00, Erosion and Sedimentation Controls.

1.6 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.7 COORDINATION

- A. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 PRODUCTS

2.1 FILL MATERIALS

- A. General fill: As specified in Section 31 00 00.
- B. Aggregate Fill: As specified in Section 31 00 00, Section 31 05 17, and the Plans.
- C. Structural Fill: As specified in Section 31 00 00.
- D. Concrete: Structural concrete as specified in Section 03 30 00 with compressive strength of 3,000 psi.
- E. Lean Concrete: Non-structural concrete with a compressive strength of 2,000 psi.

PART 3 EXECUTION

3.1 LINES AND GRADES

- A. Lay pipes to lines and grades indicated on Drawings.
 - 1. Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.
- B. Use laser-beam instrument with qualified operator to establish lines and grades.
- C. Maintain proper horizontal alignment of utilities not laid on grade.

*CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA*

3.2 PREPARATION

- A. Call Alabama One Call service at 1-800-292-8525 not less than three working days before performing Work.
 - 1. Request underground utilities to be located and marked within and surrounding construction areas.
- B. Identify required lines, levels, contours, and datum locations.
- C. Protect plant life, lawns, and other features remaining as portion of final landscaping.
- D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- E. Maintain and protect above and below grade utilities indicated to remain.
- F. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of Work.

3.3 TRENCHING

- A. Erect erosion control devices prior to excavation.
- B. Excavate subsoil required for utilities to the depth indicated on the Drawings.
- C. Remove lumped subsoil, boulders, and rock up of 1/6 cubic yard, measured by volume. Remove larger material as specified in Section 31 00 00.
- D. Perform excavation within 24 inches of existing utility in accordance with utility's requirements.
- E. Do not advance open trench more than 400 feet ahead of installed pipe.
- F. Excavate trenches to uniform width, sufficiently wide to provide ample working room and a minimum of 12 inches of clearance on each side of pipe or conduit.
- G. Remove water or materials that interfere with Work.
- H. Excavate trenches and conduit to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on undisturbed soil and bedding material. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- I. Do not interfere with 45 degree bearing splay of building foundations or roadbeds.
- J. When subsurface materials at bottom of trench are loose or soft, notify Engineer, and request instructions.
- K. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Fill Type A1 and compact to density equal to or greater than requirements for subsequent backfill material.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

- L. Correct over excavated areas with compacted backfill as specified for authorized excavation or replace with concrete as directed by Engineer.
- M. Remove excess subsoil not intended for reuse, from site.
- N. Maintain trench depth sufficient to provide a minimum cover of 30 inches over utility pipe unless otherwise noted in the Drawings. Maintain a minimum of 36 inches cover under highway ditches.

3.4 STABILITY OF EXCAVATIONS

- A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction. Design of retaining structures must be performed, signed and sealed by a registered engineer licensed in the state in which the project is located.
- B. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.
- C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses.
 - 1. Provide permanent steel sheet piling or reinforced concrete drilled shaft walls wherever subsequent removal of retaining structure might permit lateral movement of soil under adjacent structures. Cut off tops a minimum of 2'-6" below final grade and leave permanently in place.
- D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.
- E. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.5 BACKFILLING

- A. General: Place soil material in maximum 8-inch loose layers to required final subgrade elevations.
 - 1. Under grassed areas, use satisfactory excavated or borrow material, or a combination. The final soil lift should be the required thickness of topsoil.
 - 2. Under walks and pavements, use base material, satisfactory excavated or borrow material, or a combination. The final fill lift should be the required thickness of base.
 - 3. Under piping and conduit and equipment, use base materials where required over rock bearing surface and for correction of unauthorized excavation. Shape excavation bottom to fit bottom 90° of cylinder.
 - 4. Backfill trenches with concrete where trench excavations pass within 18" of

CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- column or wall footings and that are carried below bottom of such 11 footings or that pass under wall footings. Place concrete to level of bottom of adjacent footing.
- a. Do not backfill trenches until tests and inspections have been made and backfilling is authorized by Engineer. Use care in backfilling to avoid damage or displacement of pipe systems.
5. Provide 4" thick concrete base slab support for piping or conduit less than 2'-6" below surface of roadways. After installation and testing of piping or conduit, provide minimum 4-" thick encasement (sides and top) of concrete prior to backfilling or placement of roadway base.
- B. Backfill excavations as promptly as work permits, but not until completion of the following:
1. Acceptance of construction below finish grade including, where applicable, damp proofing, waterproofing, and perimeter insulation.
 2. Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded. 3
 3. Removal of concrete formwork.
 4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities or leave in place if required.
 5. Removal of trash and debris from excavation.
 6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.
- C. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, underground structures (foundations, slabs, walls and utilities), and deleterious materials from area prior to placement of fills. Backfill disturbed areas with compacted and tested fill. Contractor shall notify City to evaluate the natural ground prior to fill placement. Contractor shall provide pneumatic-tired equipment capable of producing the pressure equal to that produced by a fully loaded, tri-axle dump truck for use in evaluation.
1. When existing ground exhibits instability, scarify ground surface, moisture condition to within 2% of the optimum moisture content, and compact to the project requirements or remove and replace unstable soils with suitable, compacted soils.
 2. Bench sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface. Benches shall consist of alternating horizontal and vertical soil surfaces in the original ground at least 4' in width and height, respectively.
 3. Overbuild slopes and cut back to the desired configuration to ensure the soils at the slope face are properly compacted and tested. 12 D. Place backfill and fill materials in layers not more than 8" in loose depth for material compacted by heavy compaction equipment, and not more than 4" in loose depth for material compacted by hand-operated tampers.
- D. Before compaction, moisten or aerate each layer of fill as necessary to provide moisture content within the fill at $\pm 2\%$ of the optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

- E. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to require elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.
 - F. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by Engineer if soil density tests indicate inadequate compaction.
 - 1. Percentage of Maximum Standard Proctor density Requirements: Compact soil to not less than 98% of the maximum Standard Proctor density, in accordance with ASTM D 698.
 - 2. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.
 - a. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density
 - b. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by disking, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.
 - G. Pipe Bedding in Unpaved Areas
 - 1. Bedding: Fill Type A2
 - 2. Cover and Backfill: As shown in detail
 - H. Pipe and Bedding in Paved Areas
 - 1. Bedding: Fill Type A2
 - 2. Cover and Backfill: As shown in detail
- a. PROTECTION OF FINISHED WORK
- i. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

**SECTION 31 25 00
EROSION AND SEDIMENTATION CONTROLS**

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Silt Fences.
 - 2. Diversion Channels.
 - 3. Rock Energy Dissipater.
 - 4. Paved Energy Dissipater.
 - 5. Rock Basin.
 - 6. Rock Barriers.
 - 7. Sediment Ponds.
 - 8. Sediment Traps.

- B. Related Sections:
 - 1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T88 - Standard Specification for Particle Size Analysis of Soils.
 - 2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

- B. American Concrete Institute:
 - 1. ACI 301 - Specifications for Structural Concrete.

- C. ASTM International:
 - 1. ASTM C127 - Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.
 - 2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 3. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - 4. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

- D. Precast/Prestressed Concrete Institute:
 - 1. PCI MNL-116S - Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures.
- B. Product Data: Product Data: Submit data on joint filler joint sealer and geotextile.
- C. Submit Erosion Control Plan along with application for Stormwater NPDES permit to Engineer prior to placement of erosion control devices.
- D. Submit manufacturer's catalog sheets and other pertinent information on filter fabrics showing that they meet or exceed the requirements of this specification.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution Requirements.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements.
- B. Do not place grout when air temperature is below freezing.
- C. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.
- D. Silt fence should not be installed across streams, ditches, waterways, or other concentrated flow areas.

PART 2 PRODUCTS

2.1 SILT FENCE MATERIALS

- A. Geotextile fabric shall be a 36" wide, nonwoven filter fabric composed of polypropylene, polyethylene, ethylene, or polyamide material.
- B. Minimum grab strength shall be 100 lbs. in any direction.
- C. Apparent opening size shall be 30 (maximum sieve size).
- D. Flow rate shall be 25 gallons/minute/square foot.
- E. Ultraviolet ray inhibitors and stabilizers shall provide a maximum of 6 months of expected usable life.
- F. Type A silt fence shall include a 36" wide, 12-1/2 gauge galvanized wire fence reinforcement to be placed with the geotextile material. Wire fence shall have openings no larger than 6 inches by 6 inches. Type B silt fence shall be a 36" wide fabric with no wire fence reinforcement.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

- G. Fence posts shall be minimum 2" x 2" oak, 60" long or steel T-post for Type B silt fence. Steel T-posts or 4" x 4" pressure treated wood posts shall be required for Type A silt fence. Minimum bury depth for wood posts is 24 inches.

2.2 ROCK

- A. Rock: Sound, hard and angular shape; well graded; without shale seams, structural defects and foreign substances; with width and thickness greater than one third its length. Refer to Section 31 37 00.

2.3 CONCRETE MATERIALS AND REINFORCEMENT

- A. Concrete: As specified in Section 03 30 00.
- B. Water: Clean and not detrimental to concrete.
- C. Reinforcement Steel: As specified in Section 03 20 00.

2.4 BLOCK, STONE, AGGREGATE, AND SOIL MATERIALS

- A. Precast Solid Concrete Block.
- B. Soil Backfill: Soil as specified in Section 31 00 00.

2.5 PLANTING MATERIALS

- A. Seeding and Soil Supplements: As specified in Section 31 10 00.
- B. Mulch: As specified in Section 31 10 00.

2.6 PIPE MATERIALS

- A. Pipe: Corrugated Plastic (HDPE).

2.7 SOURCE QUALITY CONTROL (AND TESTS)

- A. Section 01 40 00 - Quality Requirements.
- B. Perform tests on cement, aggregates, and mixes to ensure conformance with specified requirements.
- C. Make rock available for inspection at producer's quarry prior to shipment. Notify Engineer at least seven days before inspection is allowed.
- D. Allow witnessing of inspections and testing at manufacturer's test facility. Notify Engineer at least seven days before inspections and tests are scheduled.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements.
- B. Verify location of existing streams, drainage structures and environmentally sensitive areas prior to placing erosion control devices.
- C. Verify compacted subgrade, granular base or stabilized soil is acceptable and ready to support devices and imposed loads.
- D. Verify gradients and elevations of base or foundation for other work are correct.

3.2 SILT FENCE

- A. The silt fence should be purchased in a continuous roll cut to length to avoid the use of joints. When joints are unavoidable, fabric should be spliced together at a post with a minimum 6 inch overlap.
- B. Post installation should start at the center of the low point with remaining posts spaced 10 feet apart for Type A and 7 feet apart for Type B fence.
- C. Anchor fabric by entrenching the bottom edge in a 6 inch deep trench and backfilling.
- D. Hay or straw bales shall be placed at each end of the silt fence.

3.3 DIVERSION CHANNELS

- A. Windrow excavated material on low side of channel.
- B. Compact to 95 percent maximum density.
- C. On entire channel area, apply soil supplements and sow seed as specified in Section 31 10 00.
- D. Mulch seeded areas with hay as specified in Section 31 10 00.

3.4 ROCK ENERGY DISSIPATOR

- A. Excavate to indicated depth of rock lining or nominal placement thickness as follows. Remove loose, unsuitable material below bottom of rock lining, then replace with suitable material. Thoroughly compact and finish entire foundation area to firm, even surface.

NCSA Class	Nominal Placement Thickness
R8	48 inches
R7	36 inches
R6	30 inches
R5	24 inches

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

R4	18 inches
R3	12 inches

- B. Lay and overlay geotextile fabric over substrate. Lay fabric parallel to flow from upstream to downstream. Overlap edges upstream over downstream and upslope over downslope. Provide a minimum overlap of 3 feet. Offset adjacent roll ends a minimum of 5 feet when lapped. Cover fabric as soon as possible and in no case leave fabric exposed more than 4 weeks.
- C. Carefully place rock on geotextile fabric to produce an even distribution of pieces, with minimum of voids and without tearing geotextile.
- D. Unless indicated otherwise, place full course thickness in one operation to prevent segregation and to avoid displacement of underlying material. Arrange individual rocks for uniform distribution.
 - 1. Saturate rock with water. Fill voids between pieces with grout, for at least top 6 inches. Sweep surface with stiff broom to remove excess grout.
 - 2. Moist cure grouted rock for at least 3 days after grouting, using water saturated burlap in accordance with Section 03 30 00.

3.5 PAVED ENERGY DISSIPATER

- A. Excavate to the required paving depth. Remove loose, unsuitable material below bottom of paving, and then replace with suitable material. Thoroughly compact and finish entire foundation area to firm, even surface.
- B. Place forms and hold reinforcement firmly in position during placing of concrete.
- C. Mix, place and finish concrete, as specified in Section 03 30 00.
- D. Embed stones or blocks 4 inches in plastic concrete at indicated separation on slopes and channel bottom.
- E. Pave in uniform 10 foot lengths or sections.
- F. Pave in shorter sections as necessary for closures or curves.
- G. Place premolded expansion joint filler, 1/2 inch thick, cut to conform to paving cross sections, at ends of curved sections at intervals of not more than 100 feet, at end of day's work, and where paving is adjacent to rigid structure. Use joint filler with depth of 1/2 inch less than paving depth and press firmly against adjacent concrete.
- H. Form intermediate joints between sections, with two thicknesses of bituminous paper cut neatly to paving cross section.

*CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA*

3.6 ROCK BASIN

- A. Construct generally in accordance with rock energy dissipator requirements to indicated shape and depth. Rock courses may be placed in several operations but minimum depth of initial course must be 3 feet or greater.

3.7 ROCK BARRIER

- A. Determine length required for ditch or depression slope and excavate compact and foundation area to firm, even surface.
- B. Produce an even distribution of rock pieces, with minimum voids to the indicated shape, height and slope.
- C. Construct coarse aggregate filter blanket against upstream face of rock barrier to the indicated thickness.

3.8 SEDIMENTATION POND

- A. Clear and grub storage area and embankment foundation area site as specified in Section 31 10 00.
- B. Excavate key trench for full length of dam. Excavate emergency spillway in natural ground.
- C. Install pipe spillway, with anti-seep collar attached, at location indicated.
- D. Place forms and reinforcing for concrete footing at bottom of riser pipe with trash rack and anti-vortex device, as specified in Section 03 20 00. Construction of embankment and trench prior to placing pipe is not required.
- E. Mix, place, finish, and cure concrete, as specified in Section 03 30 00.
- F. Do not use coarse aggregate as backfill material around pipe. Backfill pipe with suitable embankment material to prevent dam leakage along pipe.
- G. Construct rock basin at outlet end of pipe, as specified in this Section. Place embankment material, as specified in Section 31 00 00. When required, obtain borrow excavation for formation of embankment, as specified in Section 31 00 00.
- H. On entire sedimentation pond area, apply soil supplements and sow seed as specified in Section 31 10 00.
- I. Mulch seeded areas with hay as specified in Section 31 10 00.

3.9 SEDIMENT TRAPS

- A. Clear site, as specified in Section 31 10 00.
- B. Construct trap by excavating and forming embankments as specified in Section 31 00 00.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

- C. Place coarse aggregate or rock at outlet as indicated on Drawings.
- D. Place geotextile fabric, as specified for rock energy dissipater.
- E. When required, obtain borrow excavation for formation of embankment, as specified in Section 31 00 00
- F. On entire sediment trap area, apply soil supplements and sow seed as specified in Section 31 10 00.
- G. Mulch seeded areas with hay as specified in Section 31 10 00.

3.10 SITE STABILIZATION

- A. Incorporate erosion control devices indicated on the Drawings into the Project at the earliest practicable time.
- B. Construct, stabilize and activate erosion controls before site disturbance within tributary areas of those controls.
- C. Stabilize any disturbed area of affected erosion control devices on which activity has ceased and which will remain exposed for more than 20 days.
 - 1. During non-germinating periods, apply mulch at recommended rates.
 - 2. Stabilize disturbed areas which are not at finished grade and which will be disturbed within one year in accordance with Section 31 10 00 at 90 percent of permanent application rate with no topsoil.
 - 3. Stabilize disturbed areas which are either at finished grade or will not be disturbed within one year in accordance with Section 31 10 00 permanent seeding specifications.
- D. Stabilize diversion channels, sediment traps, and stockpiles immediately.

3.11 FIELD QUALITY CONTROL

- A. Inspect erosion control devices on a weekly basis and after each runoff event. Make necessary repairs to ensure erosion and sediment controls are in good working order.
- B. Sediment should be removed from behind silt fence once it has accumulated to one-half the original height of the barrier. Fabric should be replaced whenever it has deteriorated to such an extent that the effectiveness of the fabric is reduced (approximately six months).
- C. Hay bales shall be replaced every 6 months regardless of condition.
- D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- E. Do not damage structure or device during cleaning operations.
- F. Do not permit sediment to erode into construction or site areas or natural waterways.

*CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA*

- G. Clean channels when depth of sediment reaches approximately one half channel depth.

END OF SECTION

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

DIVISION 31 00 00: EARTHWORK
Section 31 31 16: Termite Control

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and any general provisions of the Contract for each Prime Contract, including General and Supplementary Conditions and specific requirements apply to this Section

1.2 SUMMARY

- A. This Section includes soil treatment for termite control at all areas constructed on grade.

1.3 SUBMITTALS

- A. General: Submit the following according to Conditions of Contract.
- B. Product data and application instructions.
- C. Certification that products used comply with U.S. Environmental Protection Agency (EPA) regulations for termiticides.

1.4 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for preparing substrate and application.
- B. Engage a professional pest control operator who is licensed according to regulations of governing authorities to apply soil treatment solution.
- C. Use only termiticides that bear a federal registration number of the EPA and are approved by local authorities having jurisdiction.

1.5 JOB CONDITIONS

- A. Restrictions: Do not apply soil treatment solution until excavating, filling, and grading operations are completed, except as otherwise required in construction operations.
- B. To ensure penetration, do not apply soil treatment to frozen or excessively wet soils or during inclement weather. Comply with handling and application instructions of the soil toxicant manufacturer.

1.6 WARRANTY

- A. Warranty: Furnish written warranty, executed by Applicator and General Contractor, certifying

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

that applied soil termiticide treatment will prevent infestation of subterranean termites. If subterranean termite activity is discovered during warranty period, General Contractor will re-treat soil and repair or replace damage caused by termite infestation.

- B. Warranty Period: 5 years from date of Final Acceptance.
- C. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the General Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT SOLUTION

- A. General: Use an emulsible, concentrated termiticide that dilutes with water, specially formulated to prevent termites infestation. Fuel oil will not be permitted as a diluent. Provide a solution consisting of one of following chemical elements.
- B. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Subject to compliance with requirement, provide Dominion 2L , Premice 2, Phantom, or Taurus SC Termiticide / Insecticide or approved equivalent.
- C. Dilute with water to concentration level recommended by manufacturer.
- D. Other solutions may be used as recommended by Applicator if approved for intended application by local authorities having jurisdiction. Use only soil treatment solutions that are not harmful to plants.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Surface Preparation: Remove foreign matter that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and foundations. Toxicants may be applied before placing compacted fill under slabs if recommended by toxicant manufacturer.
- B. Application Rates: Apply soil treatment solution as follows:
 - 1. Under slab-on-grade structures, treat soil before concrete slabs are placed, using the following application rates:
 - a. Apply 4 gallons of chemical solution per 10 linear feet to soil in critical areas under slab, including entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers.

CALHOUN COUNTY JAIL ADDITIONS & RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- b. Apply 1 gallon of chemical solution per 10 sq. ft. as an overall treatment under slab and attached slab areas where fill is soil or unwashed gravel. Apply 1-1/2 gallons of chemical solution to areas where fill is washed gravel or other coarse absorbent material.
 - c. Apply 4 gallons of chemical solution per 10 linear feet of trench for each foot of depth from grade to footing, along outside edge of building. Dig a trench 6 to 8 inches wide along outside of foundation to a depth of not less than 12 inches. Punch holes to top of footing at not more than 12 inches o.c. and apply chemical solution. Mix chemical solution with the soil as it is being replaced in the trench.
- C. Post signs in areas of application to warn workers that soil termiticide treatment has been applied. Remove signs after areas are covered by other construction.
- D. Reapply soil treatment solution to areas disturbed by subsequent excavation, landscape grading, or other construction activities following application.

END OF SECTION 31 31 16

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

**SECTION 31 37 00
RIPRAP**

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Riprap placed loose.
 - 2. Riprap placed in bags.
- B. Related Sections:
 - 1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures.
- B. Product Data: Submit data for riprap bags, binder and geotextile fabric.
- C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.3 QUALITY ASSURANCE

- A. Furnish each aggregate material from single source throughout the Work.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Riprap: Limestone type; broken stone; solid and nonfriable; class as specified on Drawings.
- B. Bags: Woven jute, where shown on Drawings.
- C. Binder: Portland cement, not required unless detailed on Drawings.
- D. Geotextile Fabric: Non-biodegradable, non-woven, 8 oz. minimum weight.

2.2 BAGGED RIPRAP

- A. Mix riprap, cement, sand and aggregate dry.
 - 1. Cement: Maximum 10 percent of dry mixed materials by volume.
- B. Fill bags with dry ingredients to 70 percent capacity and close by sewing or stapling to straight seam.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements.
- B. Do not place riprap over frozen or spongy subgrade surfaces.

3.2 PLACEMENT

- A. Place geotextile fabric over substrate, lap edges and ends.
- B. Place riprap at culvert pipe ends, at embankment slopes, and as indicated on Drawings.
- C. Installed Thickness Per Class:
 - 1. Class 1 Thickness = 18"; Tolerance 0", +6"
 - 2. Class 2 Thickness = 24"; Tolerance -3", +15"
 - 3. Class 3 Thickness = 30"; Tolerance -3", +15"
 - 4. Class 4 Thickness = 32"
 - 5. Class 5 Thickness = 36"

3.3 SCHEDULES

- A. Culvert Pipe Ends: Loose riprap, placed one layer thick, 24 inch average thickness, extend a minimum of two feet beyond culvert wall in each direction.
- B. Sloped Grade: Loose riprap units, 18 inch thickness; placed prior to finish topsoil.

END OF SECTION

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

**SECTION 32 11 23
AGGREGATE BASE COURSE**

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Aggregate base course.
- B. Related Sections:
 - 1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. ASTM International:
 - 1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 2. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
 - 3. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - 4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
 - 5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures.
- B. Materials Source: Submit name of materials suppliers.
- C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Furnish each aggregate material from single source throughout the Work.
- B. Maintain one copy of each document on site.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

PART 2 PRODUCTS

2.1 MATERIALS

- A. Crushed Aggregate Base: As specified in Alabama Department of Transportation, Standard Specifications for Highway Construction, Latest Edition, Section 301-A and Section 825.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements.
- B. Verify subbase has been inspected, proof-rolled, gradients and elevations are correct, and is dry.

3.2 PREPARATION

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place fill on soft, muddy, or frozen surfaces.

3.3 AGGREGATE PLACEMENT

- A. Spread aggregate over prepared substrate to the total compacted thickness as shown or indicated in the Drawings.
- B. Place aggregate in maximum 6 inch layers and compact to specified density.
- C. Level and contour surfaces to elevations and gradients indicated.
- D. Maintain optimum moisture content of fill materials to attain required compaction density.
- E. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.4 TOLERANCES

- A. Section 01 40 00 - Quality Requirements.
- B. Maximum Variation from Flat Surface: 1/4 inch measured with 10 foot straight edge.
- C. Maximum Variation from Thickness: 1/2 inch.
- D. Maximum Variation from Elevation: 0.05 feet.

3.5 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements.

*CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA*

- B. Compaction testing will be performed in accordance with ASTM D1556.
- C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- D. Frequency of Tests:
 - 1. Road: 1 test per 300 linear feet per lift.
 - 2. Parking Area: 1 test per 1,500 square feet per lift.

3.6 SCHEDULES

- A. Under Asphalt Pavement:
 - 1. Compact placed aggregate materials uniformly to achieve minimum 98 percent of maximum density.
- B. Under Concrete Pavement:
 - 1. Compact placed aggregate materials uniformly to achieve minimum 98 percent of maximum density.

END OF SECTION

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

**SECTION 32 12 00
FLEXIBLE PAVING**

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Asphaltic concrete paving, wearing, binder and base course.
 - 2. Surface sealer.
 - 3. Aggregate subbase course.
- B. Related Sections:
 - 1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

- A. Asphalt Institute:
 - 1. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot- Mix Types.
 - 2. AI MS-19 - Basic Asphalt Emulsion Manual.
- B. ASTM International:
 - 1. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction.
 - 2. ASTM D3381 - Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.

1.3 PERFORMANCE REQUIREMENTS

- A. Paving: Designed for streets, drives and parking areas.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit product information and mix design.
- C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with Alabama Department of Transportation standard.
- B. Mixing Plant: Conform to Alabama Department of Transportation Standard.
- C. Obtain materials from same source throughout.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

- D. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

- A. Installer: Company specializing in performing work of this section with minimum five years documented experience.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements.
- B. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.
- C. Place bitumen mixture when temperature is not more than 15 degrees F below temperature at when initially mixed and not more than maximum specified temperature.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Binder Course: In accordance with Section 424-B “Superpave Bituminous Concrete Binder Layer, 3/4 inch maximum aggregate size mix, ESAL range A/B” of the Alabama Department of Transportation Standard Specifications for Highway Construction, latest edition.
- B. Wearing Surface Layer: In accordance with Section 424-A “Superpave Bituminous Concrete Wearing Surface Layer, 1/2 inch maximum aggregate size mix, ESAL range A/B” of the Alabama Department of Transportation Standard Specifications for Highway Construction, latest edition.
- C. Tack Coat: In accordance with Section 405 “Tack Coat” of the Alabama Department of Transportation Standard Specifications for Highway Construction, latest edition.

2.2 SOURCE QUALITY CONTROL AND TESTS

- A. Section 01 40 00 - Quality Requirements.
- B. Submit proposed mix design for review prior to beginning of Work.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements.
- B. Verify compacted subbase is dry and ready to support paving and imposed loads.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

- C. Verify gradients and elevations of base are correct.
- D. Verify drainage facilities, manhole frames, water valves, and other utility structures are installed in correct position and elevation.

3.2 PREPARATION - PRIMER

- A. Apply primer in accordance with ALDOT specifications.
- B. Use clean sand to blot excess primer.

3.3 PREPARATION - TACK COAT

- A. Apply tack coat in accordance ALDOT specifications.
- B. Apply tack coat on asphalt and concrete surfaces over subgrade surface at uniform rate.
- C. Apply tack coat to contact surfaces of curbs, gutters and concrete driveway turnouts.
- D. Coat surfaces of manhole and catch basin frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

3.4 PLACING ASPHALT PAVEMENT

- A. Place asphalt binder course within 12 hours of applying primer or tack coat.
- B. Place binder course to thickness identified in schedule at end of section.
- C. Place wearing course within 24 hours of placing and compacting binder course. When binder course is placed more than 24 hours before placing wearing course, clean surface and apply tack coat before placing wearing course.
- D. Place wearing course to thickness identified in Drawings.
- E. Compact each course by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- F. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.5 CURBS

- A. Install extruded asphalt curbs as indicated on Drawings.

3.6 TOLERANCES

- A. Section 01 40 00 - Quality Requirements.
- B. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

*CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA*

- C. Scheduled Compacted Thickness: Within 1/4 inch.
- D. Variation from Indicated Elevation: Within 1/2 inch.

3.7 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements.
- B. Take samples and perform tests in accordance with ASTM D1556.
- C. Frequency of Tests:
 - 1. Road: 1 test per 300 linear feet.
 - 2. Parking Area: 1 test per 1,500 square feet.

3.8 PROTECTION OF FINISHED WORK

- A. Immediately after placement, protect pavement from mechanical injury for 4 hours or until surface temperature is less than 140 degrees F.

END OF SECTION

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

**SECTION 33 01 30.13
SEWER AND MANHOLE TESTING**

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Testing Manholes:
 - a. Vacuum Test.
 - 2. Testing Gravity Sewer Piping:
 - a. Low-pressure Air Test.
 - b. Infiltration Test.
 - 3. Hydrostatic Testing Pressure Piping.
 - 4. Deflection Testing Plastic Piping.
- B. Related Sections:
 - 1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM C1244 - Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test.
 - 2. ASTM D2122 - Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures.
- B. Submit the following prior to start of testing:
 - 1. Testing procedures.
 - 2. List of test equipment.
 - 3. Testing sequence schedule.
 - 4. Provisions for disposal of flushing and test water.
 - 5. Certification of test gauge calibration.
 - 6. Deflection mandrel drawings and calculations.
- C. Test Reports: Indicate results of manhole and piping tests.

PART 2 PRODUCTS

2.1 VACUUM TESTING EQUIPMENT

- A. Vacuum pump.

*CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA*

- B. Vacuum line.
- C. Vacuum tester base with compression band seal and outlet port.
- D. Shut-off valve.
- E. Stop watch.
- F. Plugs.
- G. Vacuum gauge, calibrated to 0.1 inch Hg

2.2 AIR TEST EQUIPMENT

- A. Air compressor.
- B. Air supply line.
- C. Shut-off valves.
- D. Pressure regulator.
- E. Pressure relief valve.
- F. Stop watch.
- G. Plugs.
- H. Pressure gauge, calibrated to 0.1 psi.

2.3 INFILTRATION TEST EQUIPMENT

- A. Weirs.

2.4 HYDROSTATIC TEST EQUIPMENT

- A. Hydro pump.
- B. Pressure hose.
- C. Water meter.
- D. Test connections.
- E. Pressure relief valve.
- F. Pressure gauge, calibrated to 0.1 psi.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

2.5 DEFLECTION TEST EQUIPMENT

- A. Go, No-Go mandrels.
- B. Pull/retrieval ropes.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements.
- B. Verify manholes and piping are ready for testing.
- C. Verify trenches are backfilled.
- D. Verify pressure piping concrete reaction support blocking or mechanical restraint system is installed.

3.2 PIPING PREPARATION

- A. Lamping:
 - 1. Lamp gravity piping after flushing and cleaning.
 - 2. Perform lamping operation by shining light at one end of each pipe section between manholes; observe light at other end; reject pipe not installed with uniform line and grade; remove and reinstall rejected pipe sections; re-clean and lamp until pipe section achieves uniform line and grade.
- B. Plug outlets, wye-branches and laterals; brace plugs to resist test pressures.

3.3 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements.
- B. Testing Gravity Sewer Piping:
 - 1. Low-pressure Air Test:
 - a. Test each section of gravity sewer piping between manholes.
 - b. Introduce air pressure slowly to approximately 4 psig.
 - 1) Determine ground water elevation above spring line of pipe for every foot of ground water above spring line of pipe, increase starting air test pressure by 0.43 psig; do not increase pressure above 10 psig.
 - c. Allow pressure to stabilize for at least five minutes. Adjust pressure to 3.5 psig or increased test pressure as determined above when ground water is present. Start test.
 - d. Test:
 - 1) Determine test duration for sewer section with single pipe size from the following table. Do not make allowance for laterals.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
 MENTAL HEALTH / MEDICAL UNIT
 ANNISTON, ALABAMA**

AIR TEST TABLE

Minimum Test Time for Various Pipe Sizes

<u>Pipe Dia. (inches)</u>	<u>T(time), min/ 100 feet</u>
3	0.2
4	0.3
6	0.7
8	1.2
10	1.5
12	1.8
15	2.1
18	2.4
21	3.0
24	3.6
27	4.2
30	4.8
36	6.0

- 2) Record drop in pressure during test period; when air pressure has dropped more than 1.0 psig during test period, piping has failed; when 1.0 psig air pressure drop has not occurred during test period, discontinue test and piping is accepted.
 - 3) When piping fails, determine source of air leakage, make corrections and retest; test section in incremental stages until leaks are isolated; after leaks are repaired, retest entire section between manholes.
2. Test pipe larger than 36 inches diameter with exfiltration test not exceeding 100 gallons for each inch of pipe diameter for each mile per day for each section under test. Perform test with minimum positive head of 2 feet.
 3. Infiltration Test:
 - a. Use only when gravity piping is submerged in ground water minimum of 4 feet above crown of pipe for entire length being tested.
 - b. Maximum Allowable Infiltration: 100 gallons per inch of pipe diameter for each mile per day for section under test, include allowances for leakage from manholes. Perform test with minimum positive head of 2 feet.
- C. Testing Pressure Sewer Piping:
1. Hydrostatic Leakage Test:
 - a. Hydrostatically test each portion of pressure piping, including valve section, at 1.5 times working pressure of piping based on elevation of lowest point in piping corrected to elevation of test gauge.
 - b. Fill section to be tested with water slowly, expel air from piping at high points. Install corporation cocks at high points. Close air vents and

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
 MENTAL HEALTH / MEDICAL UNIT
 ANNISTON, ALABAMA**

corporation cocks after air is expelled and raise pressure to specified test pressure.

- c. Observe joints, fittings and valves under test. Remove and renew cracked pipe, joints, fittings, and valves showing visible leakage. Retest.
- d. Correct visible deficiencies and continue testing at same test pressure for additional 2 hours to determine leakage rate. Maintain pressure within plus or minus 5.0 psig of test pressure. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.
- e. Compute maximum allowable leakage by the following formula:

$$L = \frac{SD\sqrt{P}}{C}$$

- L = allowable, in gallons per hour
- S = length of pipe tested, in feet
- D = nominal diameter of pipe, in inches
- p = average test pressure during leakage test, in psig
- C = 133,200

When pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.

- f. When test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections and retest until leakage is within allowable limits. Correct visible leaks regardless of quantity of leakage.

D. Deflection Testing of Plastic Sewer Pipe:

- 1. Perform vertical ring deflection testing on PVC and ABS sewer piping, after backfilling has been in place for at least 30 days but not longer than 12 months.
- 2. Allowable maximum deflection for installed plastic sewer pipe limited to 5 percent of original vertical internal diameter.
- 3. Perform deflection testing using properly sized rigid ball or 'Go, No-Go' mandrel.
- 4. Furnish rigid ball or mandrel with diameter not less than 95 percent of base or average inside diameter of pipe as determined by ASTM standard to which pipe is manufactured. Measure pipe in compliance with ASTM D2122.
- 5. Perform test without mechanical pulling devices.
- 6. Locate, excavate, replace and retest pipe exceeding allowable deflection.

E. Testing Manholes:

- 1. General: Test using air whenever possible prior to backfilling to assist in locating leaks. Make joint repairs on both outside and inside of joint to ensure permanent seal. Test manholes with manhole frame set in place.
- 2. Vacuum test in accordance with ASTM C1244 and as follows:
 - a. Plug pipe openings; securely brace plugs and pipe.
 - b. Inflate compression band to effect seal between vacuum base and structure; connect vacuum pump to outlet port with valve open; draw vacuum to 10 inches of Hg; close valve; start test.
 - c. Test:
 - 1) Determine test duration for manhole from the following table:

*CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA*

VACUUM TEST TABLE

Manhole Diameter

Test Period

4 feet

60 seconds

5 feet

75 seconds

6 feet

90 seconds

- 2) Record vacuum drop during test period; when vacuum drop is greater than 1 inch of Hg during test period, repair and retest manhole; when vacuum drop of 1 inch of Hg does not occur during test period, discontinue test and accept manhole.
- 3) When vacuum test fails to meet 1 inch Hg drop in specified time after repair, repair and retest manhole.

END OF SECTION

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

**SECTION 33 05 13
MANHOLES AND STRUCTURES**

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Modular precast concrete manholes with tongue-and-groove joints, flexible boots, frame, covers, anchorage, and accessories.
 - 2. Doghouse manhole connections to existing sanitary sewer lines.
 - 3. Joint seals.
 - 4. Bedding and cover materials.
 - 5. Pile support systems.
- B. Related Sections:
 - 1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
 - 2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 3. ASTM C32 - Standard Specification for Sewer and Manhole Brick (Solid Masonry Units Made from Clay or Shale).
 - 4. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - 5. ASTM C55 - Standard Specification for Concrete Brick.
 - 6. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
 - 7. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
 - 8. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.
 - 9. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures.
- B. Shop Drawings: Indicate structure locations, elevations, piping, sizes and elevations of penetrations.
- C. Product Data: Submit manhole covers, component construction, features, configuration, and dimensions.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years experience.
- B. Installer: Company specializing in performing work of this section with minimum five years documented experience.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Section 01 60 00 - Product Requirements.
- B. Comply with precast concrete manufacturer's instructions for unloading, storing and moving precast manholes and drainage structures.
- C. Store precast concrete manholes and drainage structures to prevent damage to Owner's property or other public or private property. Repair property damaged from materials storage.
- D. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers shown on Drawings to indicate its intended use.

PART 2 PRODUCTS

2.1 MANHOLES

- A. Manufacturers:
 - 1. Hanson Pipe and Precast
 - 2. Sherman-Dixie Concrete Industries.
- B. Manhole Sections: Reinforced precast concrete in accordance with ASTM C478 with gaskets in accordance with ASTM C443.
 - 1. Joints for Precast Manholes and Structures: Manhole sections shall have a standard tongue and groove joint with an "O" -ring, conforming to ASTM Standard C-443 or butyl rope sealant such as RamNek.

2.2 FRAMES AND COVERS

- A. Manufacturers:
 - 1. East Jordan Iron Works
 - 2. John Bouchard and Sons Co.
 - 3. Neenah Foundry Co.
 - 4. Substitutions: Section 01 60 00 - Product Requirements.
- B. Product Description: ASTM A48, Class 30B Cast iron construction.
 - 1. Lid: Machined flat bearing surface, removable lid, solid cover design; traffic load rated; sealing gasket (watertight model only).

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

2. Nominal Lid Size: 24-inch diameter opening.

2.3 COMPONENTS

- A. Manhole Steps: Formed polypropylene rungs; 3/4-inch diameter.
- B. Foundation Slab: Cast-in-place concrete of size shown in Drawings, leveled top surface.
- C. Casting Seal: Butyl Mastic

2.4 CONFIGURATION

- A. Manholes shall be manufactured with Type II, sulfide resistant concrete having a minimum 28-day compressive strength of 4,000 psi.
- B. Minimum wall thickness of the riser sections shall be as follows:

48" I.D. – 5"	60" I.D. – 6"	72" I.D. – 7"
---------------	---------------	---------------
- C. Cone Sections - The upper precast cone sections shall be of the concentric type with a minimum height of 24". Flat top slabs shall be used in all non-traffic areas. Joints between manhole sections will be made with offset joints with rubber gaskets or preformed butyl sealants.
- D. Two lift holes shall be cast into each manhole section.
- E. Openings shall be provided in the manhole sections at the locations and elevations shown on the Drawings.
- F. Flexible manhole sleeves, or boots, shall be used to connect each pipe to the manhole. Sleeve to be made of EPDM rubber with bands and clamps made of 304 stainless steel. Sleeve shall be as manufactured by KOR-N-SEAL or equal.
- G. Steps: 3/4 inch diameter reinforced plastic, 12 inches wide, 16 inches on center vertically, set into structure wall with a minimum embedment of 3-3/8 inches.

2.5 ACCESSORIES

- A. Watertight Polyethylene Manhole Insert:
 1. Manufacturers:
 - a. Parsons Environmental Products.
 - b. No Flow Inflow.
 - c. Substitutions: Section 01 60 00 - Product Requirements.
- B. External Seal Wrap
 1. Each manhole joint shall be sealed with an external rubber sleeve made of Ethylene Propylene Diene Monomer (EPDM) rubber with a minimum thickness of 30 mils.
 2. The back side of each unit shall be coated with a non-hardening butyl rubber mastic with a minimum thickness of 187 mils.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

3. The adjustment rings and the castings shall also be sealed with an external rubber seal wrap made of EPDM rubber with a minimum thickness of 65 mils.
4. Manufacturers:
 - a. Sealing Systems, Inc (Infi-Shield)
 - b. Canusa-CPS (Wrapidseal).
 - c. Concrete Sealants, Inc. (ConSeal).
 - d. Substitutions: Section 01 60 00 - Product Requirements.

2.6 BEDDING AND COVER MATERIALS

- A. Pipe Bedding in Unpaved Areas
 1. Bedding: Fill Type A2
 2. Cover and Backfill: As shown in detail
- B. Pipe and Bedding in Paved Areas
 1. Bedding: Fill Type A2
 2. Cover and Backfill: As shown in detail

2.7 PILE SUPPORT SYSTEMS

- A. Timber Piles: Conform to Section 31 62 19.
- B. Timber for Cradle: Southern Yellow Pine well seasoned conforming to Section 31 62 19 and surfaced four sides with preservative treatment.
- C. Preservative Treatment for Timber: Conform to Section 06 03 13.23.
- D. Concrete Cradle: Conforming to Section 03 30 00. 4,000 psi, 28-day reinforced concrete, rough troweled finish.
- E. Concrete Reinforcement: Conform to Section 03 20 00.

2.8 FINISHING - STEEL

- A. Galvanizing: ASTM A123/A123M; minimum 1.2 oz/sq ft coating thickness; galvanize after fabrication.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements.
- B. Verify items provided by other sections of Work are properly sized and located.
- C. Verify built-in items are in proper location, and ready for roughing into Work.
- D. Verify correct size of manhole and structure excavation.

*CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA*

3.2 PREPARATION

- A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.
- B. Do not install manholes and structures where site conditions induce loads exceeding structural capacity of manholes or structures.
- C. Inspect precast concrete manholes and structures immediately prior to placement in excavation to verify manholes and structures are internally clean and free from damage. Remove and replace damaged units.

3.3 INSTALLATION - GENERAL

- A. Excavation and Backfill:
 - 1. Excavate for manholes and structures in accordance with Section 31 00 00 in location and to depth shown. Provide clearance around sidewalls of manhole or structure for construction operations, granular backfill [and placement of geotextile filter fabric where required.
 - 2. When groundwater is encountered, prevent accumulation of water in excavations. Place manholes or structures in dry trench.
 - 3. Where possibility exists of watertight manhole or structure becoming buoyant in flooded excavation, anchor manhole or structure to avoid flotation.
- B. Place foundation slab, trowel top surface level.
- C. Install manholes and structures supported at proper grade and alignment on crushed stone bedding as shown on Drawings.
- D. Where groundwater is encountered in excavation, install vertical pipe adjacent to manhole of sufficient diameter to allow monitoring of groundwater in trench. Place pipe above trench bottom to allow accurate groundwater level measurement. Upon completion of low pressure air testing of gravity sewer, remove pipe and backfill.
- E. Backfill excavations for manholes and structures in accordance with Section 31 00 00.
- F. Place manhole plumb and level, to correct dimensions and elevations.
- G. Grout base section to achieve sloped bench toward invert. Trowel smooth. Contour to form continuous drainage channel as indicated on Drawings.
- H. Set cover frames and covers level without tipping, to correct elevations.

3.4 PRECAST CONCRETE MANHOLE AND STRUCTURE INSTALLATION

- A. Lift precast manholes and structures at lifting points designated by manufacturer.
- B. When lowering manholes and structures into excavations and joining pipe to units, take precautions to ensure interior of pipeline and manhole or structure remains clean.

CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- C. Set precast manholes and structures bearing firmly and fully on crushed stone bedding, compacted in accordance with provisions of Section 31 00 00 or on other support system shown on Drawings.
- D. Assemble multi-section manholes and structures by lowering each section into excavation. Install rubber gasket joints between precast sections in accordance with manufacturer's recommendations. Lower, set level, and firmly position base section before placing additional sections.
- E. Remove foreign materials from joint surfaces and verify sealing materials are placed properly. Maintain alignment between sections by using guide devices affixed to lower section.
- F. Seal manhole joints with rubber external wrap.
- G. Verify manholes and structures installed satisfy required alignment and grade.
- H. Cut pipe to finish flush with interior of manhole or structure.
- I. All pipe connections to manhole shall be installed using watertight sleeves as per 2.4G.
- J. Grout base section to achieve sloped bench toward invert. Trowel smooth. Contour to form continuous drainage channel as indicated on Drawings.

3.5 DOGHOUSE MANHOLE AND STRUCTURE INSTALLATION

- A. Stake out location and burial depth of existing sewer line in area of proposed manhole or structure.
- B. Carefully excavate around existing sewer line to adequate depth for foundation slab installation. Protect existing pipe from damage. Cut out soft spots and replace with granular fill compacted to 95% dry density.
- C. Prepare crushed stone bedding or other support system shown on Drawings, to receive foundation slab as specified for precast manholes and structures.
- D. Install pre-cast concrete manhole around existing pipe in accordance with the appropriate paragraphs specified herein.
- E. Seal manhole joints with rubber external wrap.
- F. Grout pipe entrances in accordance with Section 03 30 00.
- G. Perform connection to existing pipe between the hours of 9:00 a.m. and 4:00 p.m.
- H. Block upstream flow at existing manhole or structure with expandable plug.
- I. Use hydraulic saw to cut existing pipe at manhole or structure entrance and exit and along pipe length at a point halfway up the outside diameter on each side of the pipe. Bottom half

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

of pipe shall remain as manhole flow channel. Saw cut to have a smooth finish with top half of pipe flush with interior of manhole or structure.

- J. Grout base section to achieve sloped bench toward invert. Trowel smooth. Contour to form continuous drainage channel as indicated on Drawings.

3.6 SANITARY MANHOLE DROP CONNECTIONS

- A. Construct drop connections into sanitary manholes in accordance with Drawings.
- B. Concrete encase pipe drop connection to a minimum of 2 feet outside of manhole.
- C. Form channel from pipe drop to sweep into main channel at maximum angle of 30 degrees.

3.7 CASTINGS INSTALLATION

- A. Set frames using precast concrete or polyethylene grade rings as indicated on Drawings. Concrete brick and mortar shall not be permitted.
- B. Set frame and cover 2 inches above finished grade for manholes and other structures with covers located within unpaved areas to allow area to be graded away from cover.
- C. Bolt frame to concrete cone section or grade ring and seal with mastic or rubber wrap.

3.8 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements.
- B. Test cast-in-place concrete in accordance with Section 03 30 00.
- C. Test concrete manhole and structure sections in accordance with ASTM C497. As a minimum, each manhole shall be field tested, from invert to casting, for infiltration using a vacuum test at ten inches (10") of mercury for sixty (60) seconds with less than a one inch reduction.
- D. Vertical Adjustment of Existing Manholes and Structures:
 - 1. Where required, adjust top elevation of existing manholes and structures to finished grades shown on Drawings.
 - 2. Reset existing frames, grates and covers, carefully removed, cleaned of mortar fragments, to required elevation in accordance with requirements specified for installation of castings.
 - 3. Remove concrete without damaging existing vertical reinforcing bars when removal of existing concrete wall is required. Clean vertical bars of concrete and bend into new concrete top slab or splice to required vertical reinforcement, as indicated on Drawings.
 - 4. Clean and apply sand-cement bonding compound on existing concrete surfaces to receive cast-in-place concrete in accordance with Section 03 30 00.

*CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA*

END OF SECTION

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

**SECTION 33 12 00
WATER UTILITY DISTRIBUTION EQUIPMENT**

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe and fittings for public potable water line.
 - 2. Positive displacement meters.
 - 3. Underground pipe markers.
 - 4. Precast concrete vault.
 - 5. Pipe Support Systems.
 - 6. Pile Support Systems.
 - 7. Bedding and cover materials.

- B. Related Sections:
 - 1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

- B. American Society of Mechanical Engineers:
 - 1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

- C. ASTM International:
 - 1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
 - 2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 3. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
 - 4. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 5. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - 6. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 - 7. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
 - 8. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 9. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

10. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
 11. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- D. American Water Works Association:
1. AWWA C104 - ANSI Standard for Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
 2. AWWA C105 - ANSI Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
 3. AWWA C110 - ANSI Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm Through 1,219 mm), for Water.
 4. AWWA C111 - ANSI Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 5. AWWA C115 - ANSI Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
 6. AWWA C151 - ANSI Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
 7. AWWA C153 - ANSI Standard for Ductile-Iron Compact Fittings for Water Service.
 8. AWWA C200 - Steel Water Pipe 6 In. (150 mm) and Larger.
 9. AWWA C203 - Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.
 10. AWWA C205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 In. and Larger - Shop Applied.
 11. AWWA C206 - Field Welding of Steel Water Pipe.
 12. AWWA C207 - Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm).
 13. AWWA C208 - Dimensions for Fabricated Steel Water Pipe Fittings.
 14. AWWA C213 - Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
 15. AWWA C300 - Reinforced Concrete Pressure Pipe, Steel-Cylinder Type.
 16. AWWA C301 - Prestressed Concrete Pressure Pipe, Steel-Cylinder Type.
 17. AWWA C515 - Reduced Wall, Resilient-Seated Gate Valves for Water Supply Service.
 18. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
 19. AWWA C605 - Water Treatment - Underground Installation of Polyvinyl Chloride PVC Pressure Pipe and Fittings for Water.
 20. AWWA C606 - Grooved and Shouldered Joints.
 21. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
 22. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
 23. AWWA C702 - Cold-Water Meters - Compound Type.
 24. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
 25. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. through 12 In. (100 mm Through 300 mm), for Water Distribution.

CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

26. AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 36 In. (350 mm Through 1,200 mm), for Water Transmission and Distribution.
 27. AWWA C906 – Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Water Distribution and Transmission
 28. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.
- E. Manufacturer’s Standardization Society of the Valve and Fittings Industry:
1. MSS SP-60 - Connecting Flange Joint between Tapping Sleeves and Tapping Valves.
- F. National Fire Protection Agency:
1. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures.
- B. Shop Drawings: Indicate piping layout, including piping specialties.
- C. Product Data: Submit data on pipe materials, pipe fittings, valves and accessories.
- D. Manufacturer’s Certificates: Submit Statement of Compliance, supporting data, from material suppliers attesting that valves, hydrants, and accessories provided meet or exceed AWWA Standards and specification requirements.
- E. Fusion Technician Qualification: HDPE or Fusible PVC pipe manufacturer or pipe supplier qualification to butt-fuse pipe products.

1.4 QUALIFICATIONS

- A. Manufacturer: company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution Requirements.
- B. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements.
- B. Deliver and store materials in shipping containers with labeling in place.
- C. Block individual and stockpiled pipe lengths to prevent moving.
- D. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
- E. Store polyethylene and PVC materials out of direct sunlight.
- F. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces.

1.7 MAINTENANCE MATERIALS

- A. Furnish one valve tee wrench and one fire hydrant wrench to Owner.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 WATER PIPING

- A. Ductile Iron Pipe: AWWA C151. Bituminous outside coating: AWWA C151. Mortar Lining: AWWA C104, double thickness.
 - 1. Pipe Class: AWWA C151, for nominal thickness, rated water working pressure and maximum depth of cover. Pressure Class 350 for normal installation. Class 56 for pipe installation on river channel bottom.
 - 2. Fittings: Ductile iron, AWWA C110. Compact fittings AWWA C153.
 - a. Coating and Lining:
 - 1) Bituminous Coating: AWWA C110.
 - 2) Cement Mortar Lining: AWWA C104, double thickness.
 - 3. Joints:
 - a. Mechanical Joints: AWWA C111.
 - b. Flanged Joints: AWWA C115.
 - c. Restrained Joints: Boltless, push-on type, joint restraint independent of joint seal.
 - 4. Jackets: AWWA C105 polyethylene jacket, 10 mil polyethylene tape.
- B. Polyvinyl Chloride (PVC): AWWA C900 and AWWA C905, DR-14 Pressure Class 305 psi 200:
 - 1. Fittings: Ductile iron, AWWA C110. Compact fittings AWWA C153.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

- a. Coating and Lining:
 - 1) Bituminous Coating: AWWA C110.
 - 2) Cement Mortar Lining: AWWA C104, double thickness.
 - 2. Joints:
 - a. ASTM D3139 PVC flexible elastomeric seals. Solvent-cement couplings are not permitted.
 - b. Butt-fusion, per pipe supplier's written instructions and qualified fusion technician.
 - C. Polyvinyl Chloride (PVC): ASTM D2241, SDR-26 for 160 psig pressure rating or SDR-21 for 200 psig rating:
 - 1. Fittings: Ductile iron, AWWA C110. Compact fittings AWWA C153.
 - a. Coating and Lining:
 - 1) Bituminous Coating: AWWA C110.
 - 2) Cement Mortar Lining: AWWA C104, double thickness.
 - 2. Joints:
 - a. ASTM D3139 PVC flexible elastomeric seals. Solvent-cement couplings are not permitted.
 - b. Butt-fusion, per pipe supplier's written instructions and qualified fusion technician.
 - D. High Density Polyethylene (HDPE): Refer to Section 40 05 33
 - E. Steel Pipe: AWWA C200 Fabricated Pipe, minimum wall thickness 0.375 inches for pipe diameters up to 8 inches and 0.50 inches for pipe diameters greater than 8 inches.
 - 1. Fittings and Special Sections: AWWA C208.
 - 2. Flanges: AWWA C207 slip-on.
 - 3. Field Welding Materials:
 - a. Pipe: AWWA C206.
 - b. Joints: AWWA C205.
 - 4. Interior Cement Mortar Lining: AWWA C205.
 - 5. Buried Steel Pipe Exterior Lining:
 - a. AWWA C213, fusion-bonded epoxy coating.
- 2.2 VALVES AND FIRE HYDRANTS
- A. Furnish materials in conformance with Section 40 05 76.13.
- 2.3 VALVE BOXES
- A. 12 inch diameter Valves and Smaller: Domestic cast iron, two-piece, screw type.
 - B. Valves larger than 12 inch diameter: Domestic cast iron, three-piece, screw type; round base.
 - C. Cast iron lid marked "Water"

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

2.4 POSITIVE DISPLACEMENT METERS

- A. Furnish materials in conformance with Section 33 12 13.

2.5 UNDERGROUND PIPE MARKERS

- A. Plastic Ribbon Tape: Bright colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.
- B. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Water Service" in large letters.

2.6 PRECAST CONCRETE VAULTS

- A. Precast Concrete Vaults: Conform to Section 33 05 16.13.

2.7 METER BOXES

- A. Furnish materials in conformance with Section 33 12 13.

2.8 PIPE SUPPORTS AND ANCHORING

- A. Metal for pipe support brackets: Structural steel, thoroughly coated with epoxy paint.
- B. Metal tie rods and clamps or lugs: Galvanized steel sized in accordance with NFPA 24.

2.9 PILE SUPPORT SYSTEMS

- A. Pipe piers shall be field cast, 4000 psi, 28 day mix, as detailed in the Drawings.
- B. Timber Piles: Conform to Section 02643.
- C. Timber for Cradle: Southern Yellow Pine well seasoned conforming to Section 06100 and surfaced on all sides with preservative treatment.
- D. Preservative Treatment for Timber: Conform to Section 31 62 19.

2.10 CONCRETE ENCASEMENT AND CRADLES

- A. Concrete: Conforming to Section 03 30 00, 4,000 psi 28 day reinforced concrete, rough troweled finish.
- B. Concrete Reinforcement: Conform to Section 03 20 00.

2.11 MECHANICAL JOINT RESTRAINT

- A. Restraint devices for nominal pipe sizes 3" – 36" shall consist of multiple gripping wedges incorporated into a retainer gland meeting the requirements of ANSI/AWWA C111/A21.11, except for HDPE pipe.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

- B. The devices shall have a working pressure rating equal to that of the pipe on which it is used. Ratings are for water pressure and must include a minimum safety factor of 2:1 in all sizes.
- C. Gland body, wedges and wedge actuating components shall be cast from grade 65-45-12 ductile iron.
- D. Mechanical joint restraint shall be Series 2000PV by EBAA Iron, Inc. or equal for connecting PVC to mechanical joint fittings or Series 1100 by EBAA Iron, Inc. or equal for connecting ductile iron pipe to mechanical joint fittings.
- E. HDPE shall be fully restrained with fused-on flange adaptors, MJ adaptors, or other approved method or fitting. All recommendations and instructions for fitting from manufacturer shall be followed. No gripper-style restraints will be allowed.
- F. HDPE connections shall be longitudinally restrained per the design by restrained fittings, anchor blocks, or other approved method.

2.12 FLANGE ADAPTER

- A. Flange adaptors may be used in lieu of threaded or welded flanges of plain end ductile pipe where allowed by the Engineer. These shall not be used with HDPE.
- B. The restraints shall be manufactured of ductile iron conforming to ASTM A536.
- C. The bolt circles and bolt holes shall conform to ANSI/AWWA C110/A21.10.
- D. The restraint shall be Series 1000-EZ Flange as manufactured by EBAA Iron, Inc. or equal.

2.13 RESTRAINED COUPLING

- A. Restrained couplings are used for joining and restraining two plain end pipes of the same or dissimilar materials.
- B. Coupling shall be capable of being used on ductile iron, steel, PVC or HDPE pipe.
- C. Coupling shall be constructed of ASTM A536 ductile iron and designed with a 2:1 safety factor.
- D. Internal pipe wall stiffeners must be used when restraining HDPE.
- E. The restraint mechanism shall incorporate a plurality of individually actuating gripping surfaces to maximize restraint capability, and have torque limiting twist off nuts to insure proper actuating of the restraint devices.
- F. The restraint devices shall be coated using fusion bonded epoxy approved for potable water contact.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

- G. The coupling sleeve internal surface (wetted parts) shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C213. Sealing gaskets shall be constructed of EPDM. The coating and gaskets shall meet ANSI/NSF-61.
- H. Exterior surfaces shall be coated with a minimum of 6 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C116/A21.16.
- I. The restrained joining system shall meet the applicable requirements of AWWA C219, ANSI/AWWA C111/A21.11, and ASTM D2000.
- J. The restrained coupling system shall be Series 3800 manufactured by EBAA Iron, Inc. or and approved equal.

2.14 BEDDING AND COVER MATERIALS

- A. Pipe Bedding in Unpaved Areas
 - 1. Bedding: Fill Type A2
 - 2. Cover and Backfill: As shown in detail
- B. Pipe and Bedding in Paved Areas
 - 1. Bedding: Fill Type A2
 - 2. Cover and Backfill: As shown in detail

2.15 ACCESSORIES

- A. Concrete for Thrust Restraints: Conform to Section 03 30 00.
- B. Steel rods, bolt, lugs and brackets: ASTM A36/A36M or ASTM A307 carbon steel.
- C. Protective Coating: Bituminous coating.

2.16 FINISHING - STEEL

- A. Galvanizing: ASTM A123/A123M; minimum 2.0 oz/sq ft coating thickness; galvanize after fabrication.

2.17 ADJUSTABLE ROLLER HANGER

- A. Material: carbon steel axle with cast iron roller and socket ends.
- B. Finish: electro-galvanized.
- C. Service: designed for the suspension of pipe where longitudinal movement may occur due to expansion/contraction. Vertical adjustment is required.
- D. Rods shall be installed into existing concrete bridge deck according to manufacturer's recommendations. Wedge type or epoxy type anchors shall be used to attach the rods to the bridge deck. Anchors shall be capable of supporting four (4) times the dead load of

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

the pipe plus the water.

- E. Each hanger shall have a lower and upper roller, fully adjustable.
- F. Manufacturer:
 - 1. Empire Industries, Inc.
 - 2. Cooper B-Line
 - 3. National Pipe Hanger Corporation
 - 4. Substitutions: Section 01 60 00 – Product Requirements

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements.
- B. Verify existing utility water main size, location, and type is as indicated on Drawings.
- C. Determine exact location and size of valves and hydrants from Drawings; obtain clarification and directions from Engineer prior to execution of work.
- D. Verify invert elevations of existing work prior to excavation and installation of valves and fire hydrants.

3.2 PREPARATION

- A. Pre-Construction Site Photos:
 - 1. Take photographs along centerline of proposed pipe trench; minimum one photograph for each 50 feet of pipe trench.
 - 2. Show mail boxes, curbing, lawns, driveways, signs, culverts, and other existing site features.
 - 3. Include project description, date taken and sequential number on back of each photograph.
- B. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs. Use only equipment specifically designed for pipe material being cut. The use of chisels or hand saws will not be permitted. Grind edges smooth with beveled end for push-on connections.
- C. Remove scale and dirt on inside and outside before assembly.
- D. Prepare pipe connections to equipment with flanges or unions.
- E. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.
 - 1. Notify Owner and Engineer not less than two days in advance of proposed utility interruption.

*CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA*

3.3 BEDDING

- A. Excavate pipe trench in accordance with Section 31 00 00 for Work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated on Drawings.
- B. Dewater excavations to maintain dry conditions and preserve final grades at bottom of excavation.
- C. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 8 inches compacted depth; compact to 95 percent.

3.4 INSTALLATION - PIPE

- A. Install pipe in accordance with AWWA C600.
- B. Handle and assemble pipe in accordance with manufacturer's instructions and as indicated on Drawings.
- C. Steel Rods, Bolt, Lugs, and Brackets: Coat buried steel with one coat of coal tar coating before backfilling.
- D. Maintain 10 ft horizontal separation of water main from sewer piping unless the elevation of the top of the sewer is at least 18" below the bottom of the water main.
- E. Install ductile iron piping and fittings to AWWA C600.
- F. Weld pipe in accordance with AWWA C206. Weld joints in accordance with AWWA C205.
- G. Flanged Joints: Not to be used in underground installations except within structures.
- H. Route pipe in straight line. Relay pipe that is out of alignment or grade.
- I. Install pipe with no high points. If unforeseen field conditions arise which necessitate high points, install air release valves as directed by Engineer.
- J. Install pipe to have bearing along entire length of pipe. Excavate bell holes to permit proper joint installation. Do not lay pipe in wet or frozen trench.
- K. Prevent foreign material from entering pipe during placement.
- L. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- M. Close pipe openings with watertight plugs during work stoppages.
- N. Install access fittings to permit disinfection of water system performed under Section 33 13 00.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

- O. Establish elevations of buried piping with not less than three ft of cover. Measure depth of cover from final surface grade to top of pipe barrel.
- P. Install plastic ribbon tape continuous 12 inches below final grade of surface.
- Q. Install #10 gauge trace wire continuous 12 inches above pipe line.

3.5 POLYETHYLENE ENCASEMENT

- A. Encase piping in polyethylene where indicated on Drawings to prevent contact with surrounding backfill material.
- B. Install in accordance with AWWA C105.
- C. Terminate encasement 3 to 6 inches above ground where pipe is exposed.

3.6 INSTALLATION - METERS

- A. Install positive displacement meters in accordance with Section 33 12 13.

3.7 THRUST RESTRAINT

- A. Provide valves, tees, bends, caps, and plugs with concrete thrust blocks. Pour concrete thrust blocks against undisturbed earth. Locate thrust blocks at each elbow or change of pipe direction to resist resultant force and so pipe and fitting joints will be accessible for repair.
- B. Install tie rods, clamps, set screw retainer glands, concrete anchors or restrained joints. Protect metal restrained joint components against corrosion by applying a bituminous coating, or by concrete mortar encasement of metal area. Do not encase pipe and fitting joints to flanges.
- C. Install thrust blocks, tie rods, and joint restraint at dead ends of water main.

3.8 SERVICE CONNECTIONS

- A. Install service connections in accordance with Section 33 12 13.

3.9 BACKFILLING

- A. Backfill around sides and to top of pipe with cover fill in maximum lifts of 6 inches, tamp in place and compact to 90 percent. Place and compact material immediately adjacent to pipes to avoid damage to pipe and prevent pipe misalignment.
- B. Maintain optimum moisture content of bedding material to attain required compaction density.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

3.10 DISINFECTION OF POTABLE WATER PIPING SYSTEM

- A. Flush and disinfect system in accordance with Section 33 13 00.

3.11 FIELD QUALITY CONTROL

- A. Pressure test system to the greater of 1.25 times the working pressure at the highest point in the test segment or 1.5 times the working pressure at the point of testing, not to exceed the pipeline or valve pressure rating in the test segment. Repair leaks and re-test.
 - 1. After completion of pipeline installation, including backfill, but prior to final connection to existing system, conduct, in presence of Engineer, concurrent hydrostatic pressure and leakage tests in accordance with AWWA C600.
 - 2. Provide all equipment required to perform leakage and hydrostatic pressure tests including water storage means, acceptable water volume measurement means, pumps, piping, calibrated pressure gauges, and chart recorder. Upon request of Engineer, provide certification of calibration of equipment acceptable to Engineer.
 - 3. Test Pressure: The greater of 1.25 times the working pressure at the highest point in the test segment or 1.5 times the working pressure at the point of testing, not to exceed the pipeline or valve pressure rating in the test segment. Obtain working pressure from Engineer.
 - 4. Conduct hydrostatic test for at least six-hour duration.
 - 5. Before applying test pressure, completely expel air from section of piping under test. Provide corporation cocks so air can be expelled as pipeline is filled with water. After air has been expelled, apply test pressure. At conclusion of tests, close and permanently seal resulting piping openings.
 - 6. Slowly bring piping to test pressure and allow system to stabilize prior to conducting leakage test. Do not open or close valves at differential pressures above rated pressure.
 - 7. Examine exposed piping, fittings, valves, hydrants, and joints carefully during hydrostatic pressure test. Repair or replace damage or defective pipe, fittings, valves, hydrants, or joints discovered, following pressure test.
 - 8. Maintain test pressure within +/- 5 psi throughout test duration by pumping additional water in to the test segment. Accurately record test segment pressure continuously on chart recorder and volume of additional water supplied to test segment. Additional water supplied shall be designated as the leakage.
 - 9. No pipeline installation will be approved when leakage is greater than that determined by the following formula:
 - $L = \frac{SD\sqrt{P}}{C}$
 - L = allowable, in gallons per hour
 - S = length of pipe tested, in feet
 - D = nominal diameter of pipe, in inches
 - p = average test pressure during leakage test, in pounds per square inch gauge
 - C = 133,200
 - 10. When leakage exceeds specified acceptable rate, locate source and make repairs. Repeat test until specified leakage requirements are met.
- B. Compaction Testing for Bedding: In accordance with ASTM D1557.

*CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA*

- C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

END OF SECTION

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

**SECTION 33 12 13
WATER SERVICE CONNECTIONS**

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe and fittings for domestic water service connections to buildings.
 - 2. Corporation stop assembly.
 - 3. Curb stop assembly.
 - 4. Meter setting equipment.
 - 5. Water meters.
 - 6. Backflow preventers.
 - 7. Underground pipe markers.
 - 8. Bedding and cover materials.

- B. Related Sections:
 - 1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

- B. American Society of Mechanical Engineers:
 - 1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
 - 2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

- C. American Society of Sanitary Engineering:
 - 1. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent.
 - 2. ASSE 1013 - Reduced Pressure Principle Backflow Preventers.

- D. ASTM International:
 - 1. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
 - 2. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
 - 3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
 - 4. ASTM C858 - Standard Specification for Underground Precast Concrete Utility Structures.
 - 5. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m^{3 - 6. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft³ (2,700 kN-m/m³}

CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

7. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 8. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
 9. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
 10. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
 11. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 12. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
- E. American Welding Society:
1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
- F. American Water Works Association:
1. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
 2. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
 3. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
 4. AWWA C702 - Cold-Water Meters - Compound Type.
 5. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
 6. AWWA C800 - Underground Service Line Valves and Fittings.
 7. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in., for Water Service.
 8. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures.
- B. Product Data: Submit data on pipe materials, pipe fittings, corporation stop assemblies, curb stop assemblies, meters, meter setting equipment, service saddles, backflow preventer, and accessories.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of piping mains, curb stops, connections, thrust restraints, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements.
- B. During loading, transporting, and unloading of materials and products, exercise care to prevent any damage.
- C. Store products and materials off ground and under protective coverings and custody, away from walls and in manner to keep these clean and in good condition until used.
- D. Exercise care in handling precast concrete products to avoid chipping, cracking, and breakage.

PART 2 PRODUCTS

2.1 WATER PIPING AND FITTINGS

- A. Copper Tubing: ASTM B88, Type K, annealed:
 - 1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
 - 2. Joints: Compression connection or AWS A5.8, BCuP silver braze.
- B. PVC Pipe: SDR-21 for 200 psig rating:
 - 1. Fittings: SDR-21 PVC.
 - 2. Joints: Compression. Solvent weld not acceptable.
- C. Polyethylene Pipe: 200 psig pressure rating:
 - 1. Fittings: AWWA C901, molded.
 - 2. Joints: Compression.
- D. Municipex (PEXa) by Rehau: AWWA C904-906, ASTM F876, and ASTM F877
 - 1. Pipe: Pipe shall hold a standard designation code of PEX 1006 per ASTM F876 and conform to standard dimension ratio of SDR 9 for diameters ranging from ½” to 3”
 - 2. Fittings and Jointing: Fittings shall be as approved by AWWA C904. The following ASTM directives shall be references for fitting types.
 - a. ASTM F1807 – Brass or Copper Insert Fittings with Copper Crimp Rings
 - b. ASTM F1960 – Cold Expansion Fittings with PEX Reinforcing Rings
 - c. ASTM F2080 – Cold Expansion Fittings with Metal Compression Sleeves
- E. Seamless Type K Copper – Water Service Pipe: AWWA C800, ASTM B 88
 - 1. Pipe: Pipe shall be seamless type K soft copper water tube in accordance with ASTM standards and be furnished in coils and be rated for underground service.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

2. Fittings and Jointing: Fittings and joints shall be threaded and/or flare connections.

2.2 CORPORATION STOP ASSEMBLY

- A. Manufacturers:
 - 1. Mueller Company.
 - 2. Ford Meter Box Co.
 - 3. A. Y. McDonald Manufacturing.
 - 4. Substitutions: Section 01 60 00 - Product Requirements.
- B. Corporation Stops:
 - 1. Brass or red brass alloy body conforming to ASTM B62.
 - 2. Inlet end threaded for tapping according to AWWA C800.
 - 3. Outlet end suitable for service pipe specified.
- C. Service Saddles:
 - 1. Double strap type, designed to hold pressures in excess of pipe working pressure.

2.3 CURB STOP ASSEMBLY

- A. Manufacturers:
 - 1. Mueller Company.
 - 2. Ford Meter Box Co.
 - 3. A. Y. McDonald Manufacturing.
 - 4. Substitutions: Section 01 60 00 - Product Requirements.
- B. Curb Stops:
 - 1. Brass or red brass alloy body conforming to ASTM B62.
 - 2. Plug type valve.
 - 3. Positive pressure sealing.

2.4 METER BOX

- A. Precast Concrete Meter Box
 - 1. 20"x 14"x 12" tall.
 - 2. Concrete lid with cast iron reader.
 - 3. Provide box extensions where required.
- B. Plastic Meter Box
 - 1. 16" x 10" x 18" tall.
 - 2. Black with cast iron reader lid.
 - 3. UV resistant.
 - 4. Provide box extensions where required.

2.5 WATER METERS

- A. Manufacturers:
 - 1. Sensus.
 - 2. Substitutions: Section 01 60 00 - Product Requirements.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

- B. Furnish materials in accordance with utility company standards.
- C. AWWA C700, positive displacement disc type suitable for fluid with bronze case and cast iron frost-proof, breakaway bottom cap, hermetically sealed register.
- D. Meter: Brass body turbine meter with magnetic drive register.
 - 1. Service: Potable Water.
 - 2. Size: 5/8 inch x 3/4 inch
 - 3. Unit of Measure: U.S. Gallons
 - 4. Maximum Operating Pressure: 150 psi.
 - 5. Accuracy: 1/4 gpm @ 95% accuracy.
 - 6. Register Type: Remote Read.

2.6 BACKFLOW PREVENTERS

- A. Manufacturers:
 - 1. Mueller Company.
 - 2. Ford Meter Box Company.
 - 3. A. Y. McDonald Corporation.
 - 4. Substitutions: Section 01 60 00 - Product Requirements.
- B. Reduced Pressure Backflow Preventers:
 - 1. Comply with ASSE 1013.
 - 2. Bronze body, with bronze internal parts and stainless steel springs.
 - 3. Two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve opening under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.
- C. Double Check Valve Assemblies: Comply with ASSE 1012; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements.
- B. Verify building service connection and municipal utility water main size, location, and invert are as indicated on Drawings.

3.2 PREPARATION

- A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

- C. Prepare pipe connections to equipment with flanges or unions.

3.3 INSTALLATION - CORPORATION STOP ASSEMBLY

- A. Make connection for each different kind of water main using suitable materials, equipment and methods approved by the Engineer.
- B. Provide service clamps for mains other than of cast iron or ductile iron mains.
- C. Screw corporation stops directly into tapped and threaded iron main at 10 and 2 o'clock position on main's circumference; locate corporation stops at least 12 inches apart longitudinally and staggered.
- D. For plastic pipe water mains, provide full support for service clamp for full circumference of pipe, with minimum 2 inches width of bearing area; exercise care against crushing or causing other damage to water mains at time of tapping or installing service clamp or corporation stop.
- E. Use proper seals or other devices so no leaks are left in water mains at points of tapping; do not backfill and cover service connection until approved by the Architect/Engineer.

3.4 BEDDING

- A. Excavate pipe trench in accordance with Section 31 00 00 for Work of this Section.
- B. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 8 inches compacted depth; compact to 95 percent.
- C. Backfill around sides and to top of pipe in accordance with Section 31 00 00.
- D. Place fill material in accordance with Section 31 00 00.

3.5 INSTALLATION - PIPE AND FITTINGS

- A. Group piping with other site piping work whenever practical.
- B. Route pipe in straight line.
- C. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- D. Install access fittings to permit disinfection of water system.
- E. Form and place concrete for thrust restraints at each elbow or change of direction of pipe main.
- F. Backfill trench in accordance with Section 31 00 00.

3.6 INSTALLATION - CURB STOP ASSEMBLY

- A. Set curb stops on gravel bed and connect to inlet side of meter.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

- B. Center and plumb meter box over meter/curb stop assembly. Set box cover 1” above finished grade.

3.7 INSTALLATION - WATER METERS

- A. Install positive displacement meters in accordance with AWWA M6, with isolating valves on inlet and outlet.

3.8 INSTALLATION - BACKFLOW PREVENTERS

- A. Install backflow preventer on outlet side of each meter and in accordance with manufacturer’s instructions.

3.9 SERVICE CONNECTIONS

- A. Install water service in accordance with utility company requirements with double check valve backflow preventer and pressure reducing valves where line pressure exceeds 80 psi.
- B. Install water meter and backflow preventer in meter box located on site.
- C. Flush and pressure test service line prior to connection of meter.

3.10 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Flush and disinfect system in accordance with Section 33 13 00.

3.11 FIELD QUALITY CONTROL

- A. Perform pressure test on water distribution system in accordance with Section 33 12 00.

END OF SECTION

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

**SECTION 33 13 00
DISINFECTION OF WATER UTILITY DISTRIBUTION**

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes disinfection of potable water distribution and transmission system; and testing and reporting results.
- B. Related Sections:
 - 1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

- A. American Water Works Association:
 - 1. AWWA B300 - Hypochlorites.
 - 2. AWWA B301 - Liquid Chlorine.
 - 3. AWWA B302 - Ammonium Sulfate.
 - 4. AWWA B303 - Sodium Chlorite.
 - 5. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
 - 6. AWWA C651 - Disinfecting Water Mains.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures.
- B. Product Data: Submit procedures, proposed chemicals, and treatment levels for review.
- C. Test Reports: Indicate results comparative to specified requirements.
- D. Certificate: Certify cleanliness of water distribution system meets or exceeds specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Disinfection Report:
 - 1. Type and form of disinfectant used.
 - 2. Date and time of disinfectant injection start and time of completion.
 - 3. Test locations.
 - 4. Name of person collecting samples.
 - 5. Initial and 24-hour disinfectant residuals in treated water in ppm for each outlet tested.
 - 6. Date and time of flushing start and completion.
 - 7. Disinfectant residual after flushing in ppm for each outlet tested.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

- B. Bacteriological Report:
 - 1. Date issued, project name, and testing laboratory name, address, and telephone number.
 - 2. Time and date of water sample collection.
 - 3. Name of person collecting samples.
 - 4. Test locations.
 - 5. Initial and 24-hour disinfectant residuals in ppm for each outlet tested.
 - 6. Coliform bacteria test results for each outlet tested.
 - 7. Certify water conforms, or fails to conform, to bacterial standards of Alabama Department of Environmental Management.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with AWWA C651.

1.6 QUALIFICATIONS

- A. Testing Firm: Company specializing in testing potable water systems.
- B. Submit bacteriologist's signature and authority associated with testing.

PART 2 PRODUCTS

2.1 DISINFECTION CHEMICALS

- A. Chemicals: AWWA B300, Hypochlorite, and AWWA B303, Sodium Chlorite.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements.
- B. Verify piping system has been cleaned, inspected, and pressure tested.
- C. Perform scheduling and disinfecting activity with start-up, water pressure testing, adjusting and balancing, demonstration procedures, including coordination with related systems.

3.2 INSTALLATION

- A. Provide and attach required equipment to perform the Work of this section.
- B. Perform disinfection of water distribution system and installation of system and pressure testing. Refer to Section 33 12 00 for pressure testing requirements.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
 MENTAL HEALTH / MEDICAL UNIT
 ANNISTON, ALABAMA**

Table 1 Weight of calcium hypochlorite granules to be placed at beginning of main and at each 500-ft interval

Pipe Diameter (<i>d</i>)	Calcium Hypochlorite Granules	
<i>in.</i>	<i>oz</i>	(<i>g</i>)
4	1.7	(48)
6	3.8	(108)
8	6.7	(190)
10	10.5	(298)
12	15.1	(428)
14 and larger	$D^2 \times 15.1$	$D^2 \times 428$

Where *D* is the inside pipe diameter, in feet $D = d/12$

3.3 TABLET/GRANULE METHOD OF CHLORINATION

A. Tablet Method:

1. The tablet method consists of placing calcium hypochlorite granules or tablets in the water main during installation and then filling the main with potable water to create a chlorine solution. This method may be used only if the pipes and appurtenances are kept clean and dry during construction.
2. WARNING: This procedure must not be used on solvent-welded plastic or on screwed-joint steel pipe because of the danger of fire or explosion from the reaction of the joint compounds with the calcium hypochlorite.

B. Placement of Calcium Hypochlorite Granules During Construction:

1. Calcium hypochlorite granules shall be placed at the upstream end of the first section of pipe, at the upstream end of each branch main, and at 500-ft intervals. The quantity of granules at each location shall be as shown in Table 1.

C. Placement of Calcium Hypochlorite Tablets During Construction:

1. Calcium hypochlorite tablets (5-grams) shall be placed in the upstream end of each section of pipe to be disinfected, including branch lines. Also, at least one tablet shall be placed in each hydrant branch and in other appurtenances. The number of 5-g tablets required for each pipe section shall be $0.0012 d^2 L$ rounded to the next higher integer, where *d* is the inside pipe diameter, in inches, and *L* is the length of the pipe section, in feet. Table 2 shows the number of tablets required for commonly used sizes of pipe. Calcium hypochlorite tablets shall be attached by an adhesive meeting the requirements of NSF/ANSI 61. There shall be adhesive only on the broadside of the tablet attached to the surface of the pipe. Attach tablets inside and at the top of the main. If the tablets are attached before the pipe section is placed in the trench, their positions shall be marked on the pipe exterior to indicate that the pipe has been installed with the tablets at the top.

D. Filling and contact time:

1. When installation has been completed, the main shall be filled with water such that the full pipe velocity is no greater than 1 ft/sec. Fill rate must be carefully controlled to ensure tablets do not come loose from pipe. Precautions shall be taken to ensure that air pockets are eliminated.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
 MENTAL HEALTH / MEDICAL UNIT
 ANNISTON, ALABAMA**

- E. The chlorinated water shall remain in the pipe for at least 24 hours. If the water temperature is less than 41°F, the water shall remain in the pipe for at least 48 hours. A detectable free chlorine residual (≥ 0.2 mb/L shall be found at each sampling point after the 24- or 48-hour period.

Table 2 Number of 5-g calcium hypochlorite tablets required for dose of 25 mg/L*

Pipe Diameter <i>in.</i>	Length of Pipe Section, <i>ft</i>				
	13 or less	18	20	30	40
	Number of 5-g Calcium Hypochlorite Tablets				
4	1	1	1	1	1
6	1	1	1	2	2
8	1	2	2	3	4
10	2	3	3	4	5
12	3	4	4	6	7
16	4	6	7	10	13

*Based on 3.25-g available chlorine per tablet

3.4 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements.
- B. Disinfection, Flushing, and Sampling:
1. Disinfect pipeline installation in accordance with AWWA C651. Use of liquid chlorine is not permitted
 2. Upon completion of retention period required for disinfection, flush pipeline until chlorine concentration in water leaving pipeline is no higher than that generally prevailing in existing system or is acceptable for domestic use.
 3. Legally dispose of chlorinated water. When chlorinated discharge may cause damage to environment, apply neutralizing chemical to chlorinated water to neutralize chlorine residual remaining in water.
 4. After final flushing and before pipeline is connected to existing system, or placed in service, employ an approved independent testing laboratory to sample, test and certify water quality suitable for human consumption.

END OF SECTION

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

**SECTION 33 31 00
SANITARY UTILITY SEWERAGE PIPING**

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sanitary sewer pipe and fittings.
 - 2. Connection to existing manholes.
 - 3. Manholes.
 - 4. Wye branches and tees.
 - 5. Sanitary Laterals.

- B. Related Sections:
 - 1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

- B. ASTM International:
 - 1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
 - 2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 3. ASTM A746 - Standard Specification for Ductile Iron Gravity Sewer Pipe.
 - 4. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
 - 5. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
 - 6. ASTM C443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
 - 7. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
 - 8. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m<sup>3 - 9. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
 - 10. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft³ (2,700 kN-m/m<sup>3 - 11. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 - 12. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.</sup></sup>

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

13. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
14. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
15. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
16. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
17. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
18. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
19. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
20. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
21. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
22. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

C. American Water Works Association:

1. AWWA C104 - American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
4. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. AWWA C150 - ANSI Standard for the Thickness Design of Ductile Iron Pipe.
6. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
7. AWWA C153 - American National Standard for Ductile-Iron Compact Fittings for Water Service.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures.
- B. Product Data: Submit catalog cuts and other pertinent data indicating proposed materials, accessories, details, and construction information.
- C. Submit reports indicating field tests made and results obtained.
- D. Manufacturer's Installation Instructions:
 1. Indicate special procedures required to install Products specified.
 2. Submit detailed description of procedures for directional drilling installation.

***CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA***

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record location of pipe runs, connections, manholes, cleanouts, and invert elevations.
- B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with Alabama Department of Environmental Management and City of Troy Utilities Department standard.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum years documented experience.

1.7 PRE-INSTALLATION MEETINGS

- A. Section 01 30 00 - Administrative Requirements.
- B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements.
- B. Deliver and store valves in shipping containers with labeling in place.
- C. Block individual and stockpiled pipe lengths to prevent moving.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements and elevations are as indicated.

1.10 COORDINATION

- A. Section 01 30 00 - Administrative Requirements.
- B. Coordinate the Work with Owner and Public Works Department.
- C. Notify affected utility companies minimum of 72 hours prior to construction.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

PART 2 PRODUCTS

2.1 SANITARY SEWER PIPE AND FITTINGS

- A. Ductile Iron Pipe: AWWA C150, AWWA C151 and ASTM A746, Class 50 or above, bell and spigot ends.
 - 1. Manufacturers:
 - a. U.S. Pipe and Foundry.
 - b. American Cast Iron Pipe Company.
 - c. McWane, Inc.
 - d. Substitutions: Section 01 60 00 - Product Requirements.
 - 2. Outside Coating: AWWA C151, asphaltic coating, 1 mil uniform thickness.
 - 3. Lining: Cement mortar lined in accordance with AWWA C104 or Ceramic Epoxy Lining (Protecto 401).
 - 4. Polyethylene encasement: AWWA C105. **(Not Used)**
 - 5. Fittings: AWWA C153 or AWWA C110, ductile iron, Class 50 or above, cement mortar lined in accordance with AWWA C104.
 - 6. Mechanical Joints: AWWA C111, rubber gasket joint devices.

- B. Plastic Pipe: ASTM D3034, Type PSM, Poly (Vinyl Chloride) (PVC) material; bell and spigot style rubber ring sealed gasket joint.
 - 1. Standard Dimension Ratio: 26
 - 2. Fittings: ASTM D-2321, PVC.
 - 3. Joints: ASTM F477, elastomeric gaskets.

- C. High Density Polyethylene Pipe: ASTM D3350
 - 1. Manufactured from materials conforming to the requirements of PE 3408 meeting cell classification 345464E for striped pipe.
 - 2. Sizes 1-1/4" – 3": AWWA C901-96 and ASTM D3035.
 - 3. Sizes 4" IPS and larger: ASTM F714 and AWWA 906-99.
 - 4. Fittings: ASTM D 3261 and AWWA 906-99.
 - 5. All polyethylene pipe and fittings shall be DR 11 (Pressure class 160 PVC equivalent).
 - 6. All pipes shall be black in color with a green stripe indicating sanitary sewer pipe.

- D. Ribbed Plastic Pipe: ASTM F794, bell and spigot style joint.
 - 1. Interior: Smooth.
 - 2. Exterior Ribs: Perpendicular to pipe axis
 - 3. Pipe Stiffness: 60 psi for 8"-12" pipe
46 psi for 15"-30" pipe.

2.2 MANHOLES

- A. Manholes: As specified in Section 33 05 13; precast concrete, 48 inch diameter, eccentric conical top, cast iron frames and covers, cover inscribed with "SANITARY SEWER."

2.3 BEDDING AND COVER MATERIALS

- A. Pipe Bedding in Unpaved Areas

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

1. Bedding: Fill Type A2
 2. Cover and Backfill: As shown in detail
- B. Pipe and Bedding in Paved Areas
1. Bedding: Fill Type A2
 2. Cover and Backfill: As shown in detail

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements.
- B. Verify trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

3.2 PREPARATION

- A. Correct over excavation with coarse aggregate.
- B. Remove large stones or other hard matter capable of damaging pipe or impeding consistent backfilling or compaction.
- C. Protect and support existing sewer lines, utilities, and appurtenances.
- D. Maintain profiles of utilities. Coordinate with other utilities to eliminate interference. Notify Engineer where crossing conflicts occur.

3.3 BEDDING

- A. Excavate pipe trench in accordance with Section 31 23 33.
- B. Excavate to lines and grades shown on Drawings or required to accommodate installation of encasement.
- C. Dewater excavations to maintain dry conditions and preserve final grades at bottom of excavation.
- D. Provide sheeting and shoring in accordance with Section 31 23 33.
- E. Place bedding material at trench bottom, level materials in continuous layer not exceeding 8 inches compacted depth; compact to 90 percent.

3.4 INSTALLATION - PIPE

- A. Install pipe, fittings, and accessories in accordance with ASTM D2321. Seal joints watertight.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

- B. Assemble and handle pipe in accordance with manufacturer's instructions except as modified on the Drawings or by Engineer.
- C. Keep pipe and fittings clean until work is completed and accepted by Engineer. Cap open ends during periods of work stoppage.
- D. Lay bell and spigot pipe with bells upstream.
- E. Polyethylene Pipe Encasement: AWWA C105.

3.5 INSTALLATION - CONNECTION TO EXISTING MANHOLE

- A. Core drill existing manhole to clean opening. Using pneumatic hammers, chipping guns, sledge hammers, is not permitted.
- B. Install watertight Link-Seal type gasket and seal with non-shrink concrete grout.
- C. Prevent construction debris from entering existing sewer line when making connection.

3.6 INSTALLATION - MANHOLES

- A. Install manholes in accordance with Section 33 05 13.

3.7 INSTALLATION - WYE BRANCHES AND TEES

- A. Install wye branches or pipe tees at locations indicated on Drawings concurrent with pipe laying operations. Use standard fittings of same material and joint type as sewer main.
- B. Maintain minimum 5 feet separation distance between wye connection and manhole.
- C. Use saddle wye or tee with stainless steel clamps for taps into existing piping. Mount saddles with solvent cement or gasket and secure with metal bands. Layout holes with template and cut holes with mechanical cutter.

3.8 INSTALLATION - SANITARY LATERALS

- A. Construct laterals from wye branch to terminal point at right-of-way.
- B. Where depth of main pipeline warrants, construct riser type laterals from wye branch.
- C. Maintain 2 feet minimum depth of cover over pipe.
- D. Maintain minimum 5 feet separation distance between laterals.
- E. Install cleanout and watertight plug, braced to withstand pipeline test pressure thrust, at termination of lateral. Install temporary marker stake extending from end of lateral to 12 inches above finished grade. Paint top 6 inches of stake with fluorescent orange paint.

*CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA*

3.9 BACKFILLING

- A. Backfill around sides and to top of pipe in accordance with Section 31 00 00.
- B. Maintain optimum moisture content of bedding material to attain required compaction density.

3.10 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements.
- B. Pressure Test: Test in accordance with Section 31 01 30.13.
- C. Infiltration Test: Test in accordance with Section 31 01 30.13.
- D. Deflection Test: Test in accordance with Section 31 01 30.13.
- E. Request inspection prior to placing bedding.
- F. When tests indicate Work does not meet specified requirements, remove work, replace and retest.

3.11 PROTECTION OF FINISHED WORK

- A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

**SECTION 33 42 13.13
PUBLIC PIPE CULVERTS**

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Pipe culverts.
 2. Accessories.
 3. Underground pipe markers.
 4. Drainage structures.
 5. Bedding and cover materials.
 6. Pipe supports and anchoring.
 7. Pile support systems.
 8. Concrete encasement and cradles.
 9. Slope protection at pipe end.
- B. Related Sections:
1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 REFERENCES

- A. American Association of State Highway and Transportation Officials:
1. AASHTO M36/M36M - Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains.
 2. AASHTO M86 - Concrete, Sewer, Storm Drain, and Culvert Pipe.
 3. AASHTO M170 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
 4. AASHTO M196/M196M - Corrugated Aluminum Pipe for Sewers and Drains.
 5. AASHTO M198 - Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets.
 6. AASHTO M206 - Reinforced Concrete Arch Culvert Storm Drain, and Sewer Pipe.
 7. AASHTO M207 - Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe.
 8. AASHTO M252 - Corrugated Polyethylene Drainage Tubing.
 9. AASHTO M259 - Precast Concrete Box Sections for Culverts, Storm Drains, and Sewers.
 10. AASHTO M273 - Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers with Less than 2 ft of Cover Subject to Highway Loadings.
 11. AASHTO M278 - Class PS 50 Polyvinyl Chloride (PVC) Pipe.
 12. AASHTO M288 - Geotextiles.
 13. AASHTO M294 - Specification for Corrugated Polyethylene Pipe, 305- to 915-mm (12- to 36-In.) Diameter.
 14. AASHTO M304M - Standard Specification for Poly (Vinyl Chloride) (PVC) Ribbed Drain Pipe & Fittings Based on Controlled Inside Diameter.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

15. AASHTO T99 - Standard Specification for the Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305 mm (12 in.) Drop.
16. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:

1. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
2. ASTM A760/A760M - Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains.
3. ASTM B745/745M - Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains.
4. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
5. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
6. ASTM C443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
7. ASTM C506 - Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe.
8. ASTM C507 - Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe.
9. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m<sup>3- 10. ASTM C1433 - Standard Specification for Precast Reinforced Concrete Box Section for Culverts, Storm Drains, and Sewers.
- 11. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft³ (2,700 kN-m/m<sup>3- 12. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- 13. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).</sup></sup>

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures.
- B. Product Data: Submit data on pipe, fittings and accessories.
- C. Manufacturer's Installation Instructions: Submit special procedures required to install Products specified.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents:
 1. Accurately record actual locations of pipe runs, connections, and invert elevations.
 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

- B. Operation and Maintenance Data: Procedures for submittals.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum five years documented experience.

1.6 PRE-INSTALLATION MEETINGS

- A. Section 01 30 00 - Administrative Requirements.
- B. Convene one week prior to commencing Work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements.
- B. Block individual and stockpiled pipe lengths to prevent moving.
- C. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
- D. Do not place pipe flat on ground. Cradle to prevent point stress.
- E. Store UV sensitive materials out of direct sunlight.

1.8 COORDINATION

- A. Section 01 30 00 - Administrative Requirements.
- B. Coordinate the Work with termination of storm sewer, trenching, connection to public storm sewer.
- C. Coordinate unrecorded or variations in site conditions, and corresponding adjustments to construction requirements.

PART 2 PRODUCTS

2.1 PIPE CULVERT

- A. Corrugated Steel Pipe: ASTM A760/A760M, galvanized.
 - 1. Helical corrugations.
 - 2. Zinc coated inside and out with 2 oz per square foot.
 - 3. Shape: As shown on Drawings.
 - 4. Coupling Bands: Galvanized steel, corrugated; 10 inches wide; connected with neoprene "O" ring gaskets and three galvanized steel bolts.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

- B. Corrugated Aluminum Pipe: ASTM B745/B745M:
 - 1. Helical corrugations.
 - 2. Shape: As shown on Drawings.
 - 3. Coupling Bands: Galvanized steel, corrugated, 10 inches wide; connected with neoprene "O" ring gaskets and three galvanized steel bolts.

- C. Reinforced Circular Concrete Pipe: ASTM C76, Class III with Wall Type B; mesh reinforcement.
 - 1. Furnish materials in accordance with Alabama Department of Transportation standards.
 - 2. Bell and spigot joints: ASTM C443, rubber compression gasket joint.
 - 3. Shape: Circular with nominal diameter as shown on Drawings.

- D. Reinforced Non-Circular Concrete Pipe:
 - 1. Reinforced Concrete Arch Pipe: ASTM C506, Class A-III, with dimensions as shown on Drawings; joints: ASTM C506.
 - 2. Precast Concrete Box Sections: ASTM C1433, Class A-III, with dimensions as shown on Drawings; joints: ASTM C1433.

- E. Corrugated Polyethylene Culvert Pipe: AASHTO M252, smooth interior, annular exterior corrugations.
 - 1. Joints: AASHTO M294, bell and spigot, polyisoprene gasket, corrugated to match pipe.

- F. Perforated Polyvinyl Chloride (PVC) Culvert Pipe: AASHTO M278.
 - 1. Joints: AASHTO M278, bell and spigot with gasket.

2.2 ACCESSORIES

- A. Geotextile Fabric: AASHTO M288, non-biodegradable, non-woven.

- B. Drainage Structures: Precast concrete, Cast-In-Place concrete, Concrete block, or polyethylene, as shown on the Drawings..
 - 1. Junction Boxes: 48 inch diameter, eccentric conical top, cast iron covers inscribed with STORM SEWER.
 - 2. Inlets: As shown on Drawings, cast iron traffic rated grate.

2.3 BEDDING AND COVER MATERIALS

- A. Bedding: Fill Type A1, as specified in Section 31 05 17.

- B. Cover: Fill as specified in Section 31 00 00.

2.4 PIPE SUPPORTS AND ANCHORING

- A. Metal for pipe support brackets: Structural steel galvanized thoroughly coated with bituminous paint.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

2.5 PILE SUPPORT SYSTEMS

- A. Timber Piles: Conform to Section 31 62 19.
- B. Timber for Cradle: Southern Yellow Pine well seasoned and surfaced four sides with preservative treatment.

2.6 CONCRETE ENCASEMENT AND CRADLES

- A. Concrete: Conforming to Section 03 30 00, 3,000 psi, 28 day reinforced concrete, rough troweled finish.
- B. Concrete Reinforcement: Conform to Section 03 20 00.

2.7 SHOP FINISHING - STEEL

- A. Galvanizing: ASTM A123/A123M; minimum 2.0 oz/sq ft coating thickness; galvanize after fabrication.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify excavation base is ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings. Notify Engineer of discrepancies.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with coarse aggregate.
- B. Remove large stones or other hard or organic matter capable of damaging piping or impeding consistent backfilling or compacting.

3.3 EXCAVATION AND BEDDING

- A. Excavate culvert trench to 6 inches below] pipe invert, in accordance with Section 31 23 33 for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.
- B. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 8 inches compacted depth, compact to 95 percent density.
- C. Place geotextile fabric over compacted bedding.
- D. Install pipe supports and anchors.

CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3.4 INSTALLATION - PIPE

- A. Lift or roll pipe into position. Do not drop or drag pipe over prepared bedding.
- B. Shore pipe to required position; retain in place until after compaction of adjacent fills. Ensure pipe remains in correct position and to required slope. Cradle bottom 20 percent of pipe diameter to avoid point load.
- C. Repair surface damage to pipe protective coating with two coats of compatible bituminous paint coating.
- D. Install cover at sides of pipe. Compact backfill by hand to one half pipe diameter.
- E. Compact at optimum moisture content.
- F. Place geotextile fabric over compacted cover.
- G. Install culvert end gratings.
- H. Refer to Section 31 00 00 for backfilling and compacting requirements. Do not displace or damage pipe when compacting.

3.5 PIPE ENDS

- A. Place fill at pipe ends, at embankment slopes, and as indicated on Drawings.
- B. Installed thickness: 4 inch average.

3.6 ERECTION TOLERANCES

- A. Section 01 40 00 - Quality Requirements.
- B. Lay pipe to alignment and slope gradients noted on Drawings; with maximum variation from indicated slope of 1/8 inch in 10 feet.
- C. Maximum Variation from Intended Elevation of Culvert Invert: 1/4 inch.
- D. Maximum Offset of Pipe from Indicated Alignment: one inch.
- E. Maximum Variation in Slope of Pipe: 0.01 percent.

3.7 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements.
- B. Request inspection prior to placing aggregate cover over pipe.
- C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

*CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA*

3.8 PROTECTION OF INSTALLED CONSTRUCTION

- A. Protect pipe and bedding from damage or displacement until backfilling operation is complete.

END OF SECTION

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

**SECTION 33 44 00
STORM UTILITY WATER DRAINS**

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Site Storm drainage piping.
 - 2. Accessories.
 - 3. Underground pipe markers.
 - 4. Catch basins and plant area drains.
 - 5. Cleanouts.
 - 6. Bedding and cover materials.
- B. Related Sections:
 - 1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 UNIT PRICE - BASIS OF MEASUREMENT

- A. Pipe and Fittings:
 - 1. Basis of Measurement: By the linear foot.
 - 2. Basis of Payment: Includes excavating, bedding, pipe and fittings, connecting to building service piping and to storm drainage system.
- B. Catch Basin and Cleanout:
 - 1. Basis of Measurement: By each unit.
 - 2. Basis of Payment: Includes excavating, bedding, unit installation with accessories, connecting to sewer piping.

1.3 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. ASTM International:
 - 1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
 - 2. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
 - 3. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
 - 4. ASTM C443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
 - 5. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

**SECTION 33 44 00
STORM UTILITY WATER DRAINS**

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Site Storm drainage piping.
 - 2. Accessories.
 - 3. Underground pipe markers.
 - 4. Catch basins and plant area drains.
 - 5. Cleanouts.
 - 6. Bedding and cover materials.
- B. Related Sections:
 - 1. Drawings and general provisions of the Contract including General and Supplemental General Conditions, and Technical Specifications.

1.2 UNIT PRICE - BASIS OF MEASUREMENT

- A. Pipe and Fittings:
 - 1. Basis of Measurement: By the linear foot.
 - 2. Basis of Payment: Includes excavating, bedding, pipe and fittings, connecting to building service piping and to storm drainage system.
- B. Catch Basin and Cleanout:
 - 1. Basis of Measurement: By each unit.
 - 2. Basis of Payment: Includes excavating, bedding, unit installation with accessories, connecting to sewer piping.

1.3 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. ASTM International:
 - 1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
 - 2. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
 - 3. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
 - 4. ASTM C443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
 - 5. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

6. ASTM C924 - Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.
7. ASTM C969 - Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
8. ASTM C1103 - Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
9. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
10. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft³ (2,700 kN-m/m³)).
11. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
12. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
13. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
14. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
15. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
16. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
17. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
18. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
19. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
20. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures.
- B. Product Data: Submit data indicating pipe, pipe accessories, and precast structures.
- C. Manufacturer's Installation Instructions: Submit special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents:
 1. Accurately record actual locations of pipe runs, connections, catch basins, and invert elevations.
 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

1.6 PRE-INSTALLATION MEETINGS

- A. Section 01 30 00 - Administrative Requirements.
- B. Convene minimum one week prior to commencing work of this section.

1.7 COORDINATION

- A. Section 01 30 00 - Administrative Requirements.
- B. Coordinate the Work with termination of storm sewer connection outside building, trenching, connection to foundation drainage system, connection to roof drain system, and connection to municipal storm sewer system.

PART 2 PRODUCTS

2.1 STORM DRAINAGE PIPING

- A. Concrete Pipe: ASTM C14, Class 3; unreinforced; maximum inside nominal diameter of 12 inches, bell and spigot ends.
 - 1. Fittings: Concrete.
 - 2. Joints: ASTM C443, rubber compression gasket joint.
- B. Reinforced Concrete Pipe: ASTM C76, Class III with Wall Type B; mesh reinforcement; bell and spigot ends.
 - 1. Fittings: Reinforced concrete.
 - 2. Joints: ASTM C443, rubber compression gasket.
- C. Plastic Pipe: ASTM D3034, Type PSM, Polyvinyl Chloride (PVC) material; bell and spigot style rubber ring sealed gasket joint.
 - 1. Fittings: PVC.
 - 2. Joints: ASTM F477, elastomeric gaskets.
- D. Corrugated Steel Pipe: plain end joints; helical lock seam; coated inside and out with 0.050 inch thick bituminous coating.
 - 1. Fittings: Corrugated steel.
 - 2. Joints: Corrugated steel pipe coupling bands, galvanized steel, 0.052 inches thick x 10 inches wide; connected with two neoprene "O" ring gaskets and two galvanized steel bolts.

2.2 ACCESSORIES

- A. Filter Fabric: Non-biodegradable, non-woven.
- B. Grout: Specified in Section 03 30 00.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

2.3 CATCH BASINS AND PLANT AREA DRAINS

- A. Catch Basin/Inlet Construction:
 - 1. Concrete block and mortar.
 - 2. Cast-in-place reinforced concrete.
 - 3. Pre-cast concrete.
 - 4. Polyethylene.
 - 5. PVC
 - 6. Substitutions: Refer to Section 01 60 00 - Product Requirements.
- B. Catch Basin/Inlet Lid and Frame:
 - 1. Construction: Cast iron.
 - 2. Load Design: Traffic rated unless otherwise shown on Drawings.
 - 3. Lid Shape: Round Junction Box Lid; Square or Rectangle Inlet Lid; As shown on Drawings.
- C. Base Pad: Cast-in-place concrete of type specified in Section 03 30 00.

2.4 BEDDING AND COVER MATERIALS

- A. Bedding: Fill Type A1 as specified in Section 31 05 17.
- B. Cover: Fill Type: Fill type A2, as specified in Section 31 05 17.
- C. Soil Backfill from Above Pipe to Finish Grade: Soil type as specified in Section 31 00 00.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements.
- B. Verify trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with fine aggregate.
- B. Remove large stones or other hard matter, which could damage piping or impede consistent backfilling or compaction.

3.3 BEDDING

- A. Excavate pipe trench in accordance with Section 31 23 33 for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.

CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

- B. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches compacted depth.
- C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE

- A. Install pipe, fittings, and accessories in accordance with ASTM D2321. Seal joints watertight.
- B. Place pipe on minimum 6 inch deep bed of Type A1 filter aggregate.
- C. Lay pipe to slope gradients noted on drawings with maximum variation from indicated slope of 1/8 inch in 100 feet.
- D. Install aggregate at sides of pipe.
- E. Refer to Section 31 00 00 for backfilling and compacting requirements. Do not displace or damage pipe when compacting.
- F. Connect to building downspouts where required.
- G. Connect to subdrainage tile system piping. Refer to Section 33 46 00.
- H. Install site storm drainage system piping to 5 feet of building. Connect to building storm drainage system.

3.5 INSTALLATION - CATCH BASINS

- A. Form bottom of excavation clean and smooth to correct elevation.
- B. Form and place Cast-In-Place Concrete base pad, with provision for storm sewer pipe end sections.
- C. Level top surface of base pad; sleeve concrete shaft sections to receive storm sewer pipe sections.
- D. Establish elevations and pipe inverts for inlets and outlets as indicated on Drawings.
- E. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.6 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements
- B. Request inspection prior to placing aggregate cover over pipe.
- C. When tests indicate work does not meet specified requirements, remove work, replace and retest.

*CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA*

D. Infiltration Test: Test in accordance with ASTM 969.

3.7 PROTECTION OF FINISHED WORK

- A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.
 - 1. Take care not to damage or displace installed pipe and joints during construction of pipe supports, backfilling, testing, and other operations.
 - 2. Repair or replace pipe that is damaged or displaced from construction operations.

END OF SECTION

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

SECTION 40 05 76.13

TAPPING SLEEVES AND VALVES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Tapping Sleeve and Valves
 - 2. Manually Operated Valves for Exposed and Buried Service.
 - 3. Air/Vacuum and Air Release Valves (Including Combination Types)
 - 4. Pilot Operated Control Valves
 - 5. Accessories
- B. Related Sections:
 - 1. Drawings and general provisions of the Contract including General Conditions, Special Provisions and Technical Specifications.

1.2 REFERENCES

- A. American Water Works Association:
 - 1. AWWA C111 / A21.11-17 – Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
 - 2. AWWA C115 - ANSI Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
 - 3. AWWA C116 – Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile Iron and Gray-Iron Fittings
 - 4. AWWA C504 – Rubber-Seated Butterfly Valves
 - 5. AWWA C508 – Swing Check Valves for Waterworks Service 2 in through 48 in
 - 6. AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service
 - 7. AWWA C512 – Air Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service.
 - 8. AWWA C515 – Reduced Wall, Resilient-Seated Gate Valves for Water-Supply Service.
 - 9. AWWA C517 – Resilient-Seated Cast Iron Eccentric Plug Valves
 - 10. AWWA C530 – Pilot-Operated Control Valves
 - 11. AWWA C541 – Hydraulic and Pneumatic Cylinder and Vane Type Actuators for Valves and Slide Gates
 - 12. AWWA C542 – Electric Motor Actuators for Valves and Slide Gates
 - 13. AWWA C550 - Protecting Epoxy Interior Coating for Valves and Hydrants.
 - 14. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
- B. National Sanitation Foundation:
 - 1. NSF 61 - Drinking Water System Components - Health Effects

*CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA*

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures.
- B. Shop Drawing:
 - 1. Installation Plan: Submit description of proposed installation.
- C. Design Data: Submit manufacturer's latest published literature include illustrations, installation instructions, maintenance instructions and parts lists.
- D. Manufacturer's Certificates: Submit Statement of Compliance and supporting data, from material suppliers stating that equipment and accessories provided meet or exceed AWWA Standards, NSF 61 certification, and specification requirements.
- E. For Pilot-Operated Control Valves, provide schematic for pilot system operation.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution Requirements.
- B. Project Record Documents: Record actual locations of valves and appurtenances.
- C. Provide Operation and Maintenance Data for equipment indicating materials of construction, recommended maintenance activities and intervals, procedures for adjustments and troubleshooting, and sources for procurement of replacement parts.
- D. For Pilot-Operated Control Valves, provide certification from manufacturer certifying installation of equipment in accordance with manufacturer's recommendations.
- E. Where the Plans or Special Provisions require such, provide spare parts and maintenance materials to Owner.

1.5 QUALITY ASSURANCE

- A. All Products for use in potable water systems shall be NSF 61 certified.

1.6 QUALIFICATIONS

- A. Manufacturer:
 - 1. Utilize equipment and materials from Owner's standard list of acceptable manufacturers provided in the Special Provisions. If no such list is provided, utilize equipment and materials from list of acceptable manufacturers provided in these specifications.
 - 2. Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

1.7 DELIVERY, STORAGE AND HANDLING

- A. Section 01 60 00 - Product Requirements.
- B. Prepare valves and accessories for shipment according to AWWA Standards and seal valve ends to prevent entry of foreign matter into product body.
- C. Store products in accordance with manufacturer's written recommendations and instructions, and in areas protected from weather, moisture, or possible damage; do not store products directly on ground.
- D. Handle products in accordance with manufacturer's written recommendations and instructions, and in such a manner as to prevent damage to interior or exterior mechanisms and surfaces.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements.
- B. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

PART 2 PRODUCTS

2.1 BASIC PROVISIONS FOR GATE, PLUG, BUTTERFLY, AND CHECK VALVES

- A. End Connections: Mechanical joint, flanged, or wafer type as indicated in the Plans. If no such indication is provided, utilize mechanical joint for buried applications and flanged joints for exposed applications. Mechanical joints shall conform to AWWA C111 and shall be provided with retainer gland devices. Flanged joints shall conform to AWWA C115 ANSI B16.1 CL 150 unless noted otherwise and shall be provided with 316 stainless steel nuts and bolts.
- B. Valve operators:
 - 1. Provide gate, plug, and butterfly valves with open-left (counterclockwise) operation.
 - 2. Provide gate valves with non-rising stems unless specifically stated otherwise in the plans.
 - 3. Provide with 2-inch square operating nut for buried applications
 - 4. Provide with handwheel operator for exposed applications with manual opening, or 2-inch square operating nut where electric or pneumatic actuator is utilized.
 - 5. Provide side-mounted right-angle gear reducer on plug and butterfly valves 6-inch and larger, and on gate valves 16 inch and larger.
- C. Coatings:
 - 1. Provide fusion-bonded epoxy coating conforming to AWWA C116 on all valves for buried applications.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

2. Provide coating in accordance with specification on all valves for exposed applications where this section is included. If section is not included provide bituminous coating.

D. Provide flow direction arrow on all plug and check valves.

2.2 TAPPING SLEEVES AND VALVES

A. Tapping Sleeves:

1. Stainless steel, full circumferential gasket, flanged outlet.
2. Manufacturers:
 - a. Mueller - Model H-615 or approved equal
3. Outlet Flange Dimensions and Drilling: ANSI B16.1, Class 125 and MSS SP-60.

B. Tapping Valves:

1. AWWA C500, resilient wedge with non-rising stem. Epoxy coated ductile iron body. Inlet flanges shall conform to ANSI B16.1, Class 150 and MSS SP-60. Mechanical joint outlets shall conform to AWWA C111.
2. Manufacturers:
 - a. Mueller

2.3 RUBBER SEATED BUTTERFLY VALVES

A. Manufacturers:

1. Dezurik
2. Pratt
3. Valmatic
4. Substitutions: Section 01 60 00 – Product Requirements

B. Valve body and disc constructed of ASTM A 536 cast iron (Grade 65-45-12). Valve disc shall be of the solid type.

C. Valve shaft constructed of ASTM A 276 Type 304 stainless steel.

D. Resilient seat constructed of Buna-N mated to Type 316 stainless steel body seat ring. Resilient seat shall be located on the valve disc and shall provide a continuous, uninterrupted seating surface.

E. All retaining hardware constructed of Type 316 stainless steel.

F. 150 psi maximum working pressure rating unless stated otherwise in the plans.

2.4 RESILIENT WEDGE GATE VALVES

A. Manufacturers:

1. American Darling or approved equal
2. Substitutions: Section 01 60 00 - Product Requirements.

B. Resilient Wedge Gate Valves: AWWA C509; iron body, bronze or ductile iron

1. Resilient seats.
2. Stem: Non-rising bronze stem.

CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Underground Valve-Operating Nut: Square; open counterclockwise unless otherwise indicated.
4. Installed Inside Structure – Flanged joint and operating hand wheel. Turn counter clockwise to open and shall have an arrow cast on the hand wheel.
5. Ends: Flanged, mechanical joint or bell end connections.
6. Coating: Fusion bonded, heat cured, thermo setting material meeting AWWA C550; interior/exterior.
7. Wedge: Cast iron, completely encapsulated with resilient material.
8. All internal parts shall be accessible without removing the body from the line. 15
9. Sizes 12-inch diameter and smaller: 200 psig working pressure.

2.5 ECCENTRIC PLUG VALVES

- A. Manufacturers:
 1. DeZurik
 2. Mueller
 3. Pratt
 4. Substitutions: Section 01 60 00 – Product Requirements
- B. Solid, one-piece plug constructed of cast iron conforming to ASTM A 126 Class B or ductile iron conforming to ASTM 536 Grade 65-45-12.
- C. Cast iron body conforming to ASTM A 126 Class B with rectangular port. Permanently lubricated sleeve-type bearings constructed of Type 316 stainless steel.
- D. Maximum working pressure rating of at least 175 psi for 12-inch and smaller valves, at least 150 psi for larger valves.

2.6 SWING CHECK VALVES

- A. Manufacturers:
 1. Dezurik
 2. M and H Valve
 3. Mueller
 4. Pratt
 5. Substitutions: Section 01 60 00 – Product Requirements.
- B. Body, disc, and disc arm constructed of ASTM A 536 ductile iron (65-45-12).
- C. Shaft shall be a single piece, constructed of Type 304 stainless steel.
- D. Valve to be of single disc type with full flow passage.
- E. Valve supplied with lever and weight unless plans require oil or air cushioning device.
- F. Valve to have bolted removable cover for cleaning and maintenance.
- G. 200 psi maximum working pressure rating for 3-inch through 12-inch valves, 150 psi for valves larger than 12-inch, unless noted otherwise in the plans.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

2.7 SILENT CHECK VALVES

- A. Manufacturers:
 - 1. Dezurik
 - 2. Pratt
 - 3. Val-Matic
 - 4. Substitutions: Section 01 60 00 – Product Requirements
- B. Valve body constructed of ASTM A536 ductile iron (65-45-12).
- C. Valve to incorporate a center guided, spring loaded disc, guided at opposite ends and having a short linear stroke that generates a flow area equal to pipe size.
- D. Seat and disc to be cast bronze or aluminum bronze. Compression spring to be Type 316 stainless steel.
- E. Valve to have a replaceable guide bushing held in position by the spring. The spring shall be designed to withstand 100,000 cycles without failure and provide a cracking pressure of 0.5 psi.
- F. Valve disc to be concave to the flow direction.
- G. Leakage rate not to exceed one-half the allowable rate for metal seated valves under AWWA C508 or 0.5 oz per hour per inch of valve diameter.
- H. 250 psi maximum working pressure rating unless noted otherwise in the plans.

2.8 AIR/VACUUM AND AIR RELEASE VALVES

- A. Manufacturers:
 - 1. ARI, Inc
 - 2. APCO Valve and Primer Company
 - 3. Crispin Valve
 - 4. Valmatic Valve Co.
 - 5. Substitutions: Section 01 60 00 - Product Requirements.
- B. Air release and air/vacuum valves shall be specifically designed by the manufacturer for either clean water service (in the case of finished potable water or other non-solids bearing water systems) or sewage service (in the case of sewerage or other potentially solids bearing systems such as raw water service) as indicated in the plans.
- C. Provide air/vacuum valves, air release valves, or combination air valves having the following functionality as indicated in the plans.
 - 1. Air/Vacuum Valves shall open to exhaust large volumes of air in situations such as pipeline filling and shall also open to admit air for the purpose of relieving internal vacuum conditions in situations such as pipeline draining.
 - 2. Air Release Valves shall open to exhaust small pockets of air while the pipeline is operating under pressure.

CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA

3. Combination Air Valves shall have the functionality of both air/vacuum valves and air release valves and may be of either the single body or dual body configured.
- D. Design Requirements:
1. Provide Air Release and Combination Air Valves with minimum 5/16-inch orifice for exhausting small pockets of air while pipeline is operating under pressure.
 2. Provide all air valves and all related accessories with pressure ratings equal to or greater than the maximum pipeline working pressure at the location of the air valve installation.
 3. Provide all air valves with low pressure sealing capability equal to or less than 2 psi or, where specifically indicated in the plans, equal to or less than 1 psi.
- E. End Connections:
1. 2-inch and smaller valves: Threaded end connections
 2. Valves larger than 2-inch: Flanged end connections conforming to ANSI B 16.1 CL 125 unless otherwise indicated in the plans.
- F. Accessories:
1. Provide the following accessories with each assembly:
 - a. For clean water service applications:
 - 1) Provide inflow preventing device which prevents entry of external water into the pipeline system through the air inlet / outlet. Device shall allow the entry or exit of air while preventing entry of water.
 - 2) Provide shut-off valve on the inlet side of the valve which allows isolation of the air valve from the pipeline system. Valve shall have the same or greater pressure rating as the pipeline system.
 - a) Utilize bronze ball valves with end connections compatible with air valve inlet connection for 2-inch and smaller air valves.
 - b) Utilize gate valve with end connections compatible with air valve inlet connection for air valves larger than 2 inches.
 - b. For sewage service applications:
 - 1) Provide backflushing accessories as follows:
 - a) Blow-off / drain connection and shut-off valve.
 - b) Clean water supply connection and shut-off valve.
 - c) Backwash supply hose with quick disconnect.
 - d) All shut-off valves shall be bronze, full-ported ball valves.
 - 2) Provide shut-off valve on the inlet side of the valve which allows isolation of the air valve from the pipeline system. Valve shall have the same or greater pressure rating as the pipeline system.
 - a) Utilize bronze ball valves with end connections compatible with air valve inlet connection for 2-inch and smaller air valves.
 - b) Utilize gate valve with end connections compatible with air valve inlet connection for air valves larger than 2 inches.

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

2.9 PILOT OPERATED CONTROL VALVES

- A. Manufacturers:
 - 1. Bermad
 - 2. Cla-Val
 - 3. Watts
 - 4. Substitutions: Section 01 60 00 - Product Requirements

- B. Globe or angle pattern as indicated in the plans with ductile iron body and cover conforming to ASTM A 536. Provide with NSF 61 listed fusion bonded epoxy coating and interior lining. Studs and cover nuts shall be 316 stainless steel.

- C. Stainless steel throttling components.

- D. All trim shall be stainless steel.

- E. Disc and diaphragm assembly shall contain a BUNA-N synthetic rubber seal securely retained on 3-1/2 sides by a disc retainer and disc guide.

- F. End Connections:
 - 1. For main valves larger than 2-inch, provide flanged end connections conforming to ASTM C115 ANSI B16.1 CL 125 unless otherwise indicated in the plans.
 - 2. For main valves 2-inch and smaller, threaded end connections may be utilized if approved by the Engineer.

- G. Pilot system:
 - 1. Regulators, fittings, and valves shall be constructed of stainless steel. Pilot system tubing shall be constructed of braided, flexible stainless steel tubing. All components of the pilot system shall have a working pressure rating in excess of the anticipated pressure conditions shown on the plans.
 - 2. Operation range suitable for the pressure range indicated in the plans.
 - 3. Provide with an external Y-strainer, adjustable opening and closing speed components, and ball-type isolation cock valves.
 - 4. All wetted surfaces contacted by consumable water shall contain less than 0.25% lead by weight.
 - 5. Pilot system manufactured and assembled by the same company as the main valve.

- H. Accessories:
 - 1. Provide brass or stainless steel engraved nameplate for each control valve and associated pilot securely affixed to the associated component. Nameplate shall indicate the following information as applicable:
 - a. Catalog and serial number
 - b. Function, size, material, and pressure rating
 - c. Type of pilot control system used and control adjustment range
 - 2. Where indicated in the plans, provide valve position indicating post.
 - 3. Where indicated in the plans, provide pressure gauges as follows:
 - a. 4-inch diameter, glycerin-filled stainless steel with the pressure measurement range as indicated in the plans.
 - b. Provide with threaded connections and stainless steel connecting tubing and fittings.

*CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA*

- c. Minimum of ½” diameter tap size or larger where indicated in the plans.
 - d. Provide with quarter-turn ball shut-off valves.
 - e. Provide with pulsation damper where indicated in the plans.
 4. Where indicated in the plans, provide main-line strainer:
 - a. Provide the same size as the control valve and installed immediately upstream from the control valve.
 - b. Ductile iron body with epoxy coating matching that of the control valve body.
 - c. Flanged end connections sized to match those of the associated control valve.
 - d. Incorporate stainless steel screen which is removable for replacement or maintenance without removing the strainer body.
 - e. NSF-61 certified.
 - f. Assembly rated for the same working pressure as the control valve.
 5. Where indicated in the plans, provide accessories, trim, and configuration which reduces internal cavitation.
 6. Where required for valve function, provide solenoids suitable for operation on 120V single-phase AC power, with NEMA IV enclosure and manual operator unless indicated otherwise in the plans.
- I. Control Valve Operations and Functionality:
 1. Control valves of the following types shall function through a pilot control system as follows:
 - a. Pressure Reducing Valves – Automatically reduce a varying upstream pressure to an operator-adjustable constant downstream pressure set point, regardless of flow rate. A decrease in downstream pressure shall cause the main valve to increase its opening, thereby increasing the downstream pressure toward the set point. An increase in downstream pressure shall cause the main valve to decrease its opening, thereby decreasing the downstream pressure toward the set point. Where specifically indicated in the plans, provide an internal check feature which prevents flow from downstream to upstream via the pilot control system.
 - b. Pressure Relief Valves – Remain closed while upstream pressure is below an operator-adjustable set point. Open to exhaust water and relieve pressure when upstream pressure exceeds the set point.
 - c. Surge Anticipator Valves – Automatically open a pre-set amount upon upstream pressure falling below an operator adjustable set point in anticipation of oncoming surge. Automatically close upon pressure rising above set point.
 - d. Pressure Sustaining Valves – Automatically maintain upstream pressure at an operator-adjustable set point with varying downstream pressure, regardless of flow rate. A decrease in upstream pressure shall cause the main valve to decrease its opening, thereby decreasing the flow rate and increasing upstream pressure toward the set point. An increase in upstream pressure shall cause the main valve to increase its opening, thereby increasing the flow rate and decreasing the upstream pressure toward the set point.
 - e. Single Acting Altitude Valves – Remain fully open until the water level in a downstream reservoir or tank reaches an operator-adjustable level setpoint, then close fully. Upon the water level in the downstream tank or

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

- reservoir falling a pre-set distance, re-open fully. This valve shall be designed for one-way flow only.
- f. Double Acting Altitude Valve – Remain fully open until the water level in a downstream reservoir or tank reaches an operator-adjustable level set point, then close fully. Upon either pressure on the upstream side falling below an operator-adjustable set point, or, the water level in the downstream reservoir or tank falling a pre-set distance, re-open fully. This valve shall be designed for two-way flow.
 - g. Solenoid-Controlled Open / Close Valve – Either open or close pilot system in response to a changing electrical current to the solenoid, which in turn either opens or closes the main valve. Solenoid shall be either normally open (open upon loss of electrical signal) or normally closed (close upon loss of electrical signal) as indicated in the plans.
 - h. Solenoid-Controlled Booster Pump Control Valve – Pump operation shall begin with the control valve closed. Upon pump start-up, simultaneously energize solenoid and begin opening the main valve slowly, as controlled by the opening speed control. Upon signal to shut-down pump, maintain the pump running, de-energize the solenoid, and begin slowly closing the main valve, as controlled by the closing speed control. Upon main valve reaching the fully-closed position, a limit switch shall release a valve / pump interlock, and the pump shall shut down. Where indicated in the plans an internal check feature shall be provided to prevent reverse flow.
 - i. Solenoid-Controlled Deep Well Pump Control Valve – Pump operation shall begin with the valve open. Upon pump start-up, simultaneously energize solenoid and begin closing the main valve slowly, as controlled by the closing pump speed control. Upon signal to shut down the pump or upon loss of power, the solenoid is de-energized, and the main valve begins to open slowly, as controlled by the opening speed control. Upon the main valve reaching the fully open position,

2.10 ACCESSORIES

- A. Valve Boxes for Buried Valves:
 1. 12-inch diameter valves and smaller: Domestic cast iron, two-piece, screw type for height adjustment.
 2. Valves larger than 12-inch: Domestic cast iron, three-piece, screw type for height adjustment.
 3. For either size condition, provide 6-inch ductile iron pipe riser sections as required for additional height where standard is insufficient.
 4. Provide with cast iron lid marked “Water” or “Sewer” as applicable.
- B. Valve Markers for Buried Valves:
 1. Provide fiberglass marker (either round or flat) or concrete monument as required in the plans. If no such indication is present, provide flat fiberglass marker.
 2. For fiberglass markers, provide either blue color for potable water or green color for sewer. Provide with Owner’s standard labeling information as indicated in the plans or specifications. If no such information is present, provide minimum labeling as follows:
 - a. “Warning – Water (Sewer) Pipeline Below”
 - b. Notification to contact 811 service before digging

**CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA**

- c. Owner's emergency contact information.
 3. For concrete markers, provide dimensions as indicated in the plans. Provide with markings as shown in the plans. If no such information is present, provide minimum information as follows:
 - a. "Water (Sewer) Valve
- C. Valve Operating Nut Stem Extensions:
 1. For buried valves where the valve operating nut is greater than 48-inches below the top of the valve box, provide a stainless steel stem extension designed to fit snugly and securely onto operating nut and with 2-inch square top operating nut designed to fit into standard valve wrench. Provide length as required so that top of operating nut is between 12 and 36 inches below the top of the valve box.
 2. For non-buried valves, provide stainless steel stem extensions and appropriate mounting brackets / guides where indicated in the plans. For applications where electric or pneumatic actuators are utilized, extensions shall be suitably sized to withstand torque imparted by actuator.
- D. Post Type Position Indicators:
 1. Manufacturers:
 - a. Mueller
 - b. M and H Valve
 - c. American Flow Control
 - d. Substitutions: Section 01 60 00 - Product Requirements.
 2. Vertical Indicator Post designed to operate a non-rising stem gate valve with above ground visual indication of valve position (open or shut).
 3. Indicator post shall feature a telescoping stem that can be adjusted to its final position without field cutting of the stem.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements.
- B. Determine exact location, configuration, features, and size of valves and accessories from the Plans; obtain clarification and directions from Engineer prior to execution of work.
- C. Verify invert elevations of existing work prior to excavation and installation.

3.2 PREPARATION

- A. Identify required lines, levels, contours and datum locations.
- B. Locate, identify, and protect utilities to remain from damage.
- C. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.

*CALHOUN COUNTY JAIL ADDITIONS AND RENOVATIONS
MENTAL HEALTH / MEDICAL UNIT
ANNISTON, ALABAMA*

3.3 INSTALLATION

- A. Install all equipment in accordance with manufacturer's instructions.

3.4 EQUIPMENT START-UP AND COMMISSIONING

- A. For pilot-operated control valves, provide on-site services of a manufacturer-certified start-up technician to initially establish set points prior to start-up and make adjustments to equipment as necessary following initial start-up. Start-up technician shall instruct Owner's staff on operation, maintenance and adjustments of equipment. Services shall be provided for a minimum of 8 hours on-site per control valve, and additionally as necessary if there are difficulties associated with the start-up, at no additional cost to the Owner.

3.5 DISINFECTION OF POTABLE WATER PIPING SYSTEM

- A. Flush and disinfect system in accordance with Section 33 13 00.

END OF SECTION