

**EXHIBIT 1
BARGE DESIGN SOLUTIONS
SOUTHPORT SPORTS COMPLEX DESIGN
08/07/2023**

SOUTHPORT SPORT COMPLEX DESIGN



BAY COUNTY

08/07/2023

Section 00 01 05

Certifications

The following licensed professionals are responsible for the various portions of the project manual by which their seal, signature and date is affixed:

- 02 41 00 - Demolition
- 03 30 00 - Cast in Place Concrete
- 22 14 13 - Storm Drainage Utilities
- 31 11 00 - Clearing and Grubbing
- 31 20 00 - Earth Moving
- 31 23 19 - Dewatering
- 31 23 33 - Trenching and Backfilling
- 32 16 00 - Concrete Sidewalks and Curbs and Gutters
- 32 17 13 - Parking Bumpers
- 33 05 61 - Manholes and Covers

Wesley Dawsey, PE



08/07/2023

3723701

- 01 40 00 - Quality Requirements
- 03 10 00 - Concrete Forming and Accessories
- 03 20 00 - Concrete Reinforcing
- 03 30 00 - Cast-in-Place Concrete
- 04 05 11 - Masonry Mortaring and Grouting
- 04 20 00 - Masonry
- 05 12 00 - Structural Steel Framing
- 05 50 00 - Metal Fabrications
- 06 10 00 - Rough Carpentry
- 06 17 63 - Shop Fabricated Wood Trusses
- 31 23 16 - Excavation
- 31 23 23 - Fill and Backfill



William T. Sealy, PE

07 41 13.16 - Standing-Seam Metal Roof Panels
07 46 46 - Fiber-Cement Siding
07 92 00 - Joint Sealants
08 11 13 - Hollow Metal Doors and Frames
08 31 13 - Access Doors and Frames
08 33 23 - Overhead Coiling Doors
08 51 13 - Aluminum Windows
08 71 00 - Door Hardware
08 80 00 - Glazing
08 83 00 - Mirrors
09 29 00 - Gypsum Board
09 30 13 - Ceramic Tiling
09 65 13 - Resilient Base and Accessories
09 91 13 - Exterior Painting
09 91 23 - Interior Painting
10 14 19 - Dimensional Letter Signage
10 21 13.17 - Phenolic-Core Toilet Compartments
10 28 00 - Toilet, Bath, And Laundry Accessories
10 44 13 - Fire Protection Cabinets
10 44 16 - Fire Extinguishers
31 31 16 - Termite Control

Victoria Williams, AIA



Digitally signed by Victoria Williams
DN: cn=Victoria Williams,
o=VBA Design, Inc., ou,
email=vwilliams@vbadesign.
us, c=US
Date: 2023.08.24 14:06:48
-05'00'

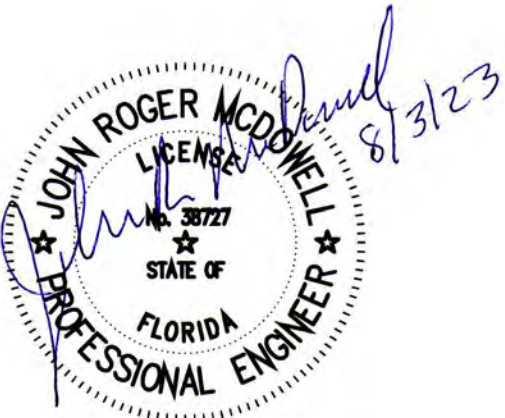
- 22 11 01 - Water Distribution System
- 22 11 17 - Reclaimed Water and Accessories
- 22 13 13 - Sewer Collection System
- 22 13 13.13 - Sewage Force Main System
- 22 13 33 - Grinder Pump Station
- 33 05 07.13 - Horizontal Directional Drilling

Tonny Peters, PE



23 00 00 - Conditions for Mechanical Systems (HVAC And Plumbing)

John R. McDowell, PE



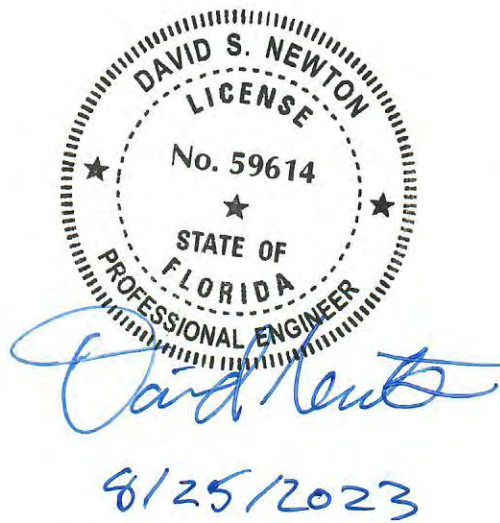
- 26 00 00 - General Electrical
- 26 05 19 - Conductors
- 26 05 26 - Grounding
- 26 05 33 - Raceways and Boxes
- 26 05 43 - Service Entrance (Underground)
- 26 22 13 - General Lighting and Distribution Transformers
- 26 24 16 - Panelboards
- 26 26 16 - Safety Switches and Circuit Breakers
- 26 27 26 - Wiring Devices
- 26 51 00 - Lighting Fixtures
- 26 55 68 - Sports Field Lighting
- 27 10 00 - DataCommunications
- 27 30 00 - DataCom and Cable TV Raceway Systems

Ron Nix, PE



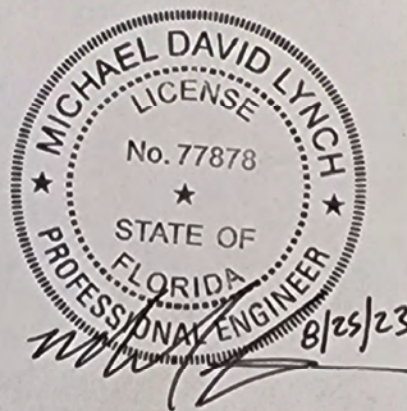
32 17 23 - Pavement Markings.docx David Newton

David Newton, PE



- 01 11 00 - Summary of Work
- 01 22 00 - Measurement and Payment
- 01 25 00 - Substitution Procedures
- 01 29 37 - Schedule of Values
- 01 32 16 - Construction Schedule
- 01 32 33 - Construction Videos and Photographs
- 01 33 00 - Submittal Procedure
- 01 65 00 - Product Delivery Requirements
- 01 71 15 - Mobilization – Demobilization
- 01 71 23 - Construction Staking
- 01 74 00 - Cleaning and Waste Management
- 01 78 23 - Operation and Maintenance Data
- 01 78 36 - Warranties

Michael Lynch, PE



32 84 00.0 – Irrigation System

Michael Clark, PE



- 00 21 14 - Supplementary Instructions to Bidder – Sports Field Contactors
- 32 31 13.10 - PVC Coated Galvanized Chain Link Fences and Gates
- 32 90 01 - Sportsfield Construction and Laser Grading
- 32 91 13.19 - Planting Soils
- 32 92 00 - Lawns and Grasses
- 32 93 00 - Trees Plants and Ground Covers



Matthew S. Stovall, PLA

END OF SECTION

SPECIFICATIONS

Section Title

Division 00 – Procurement and Contracting

00 21 14 Supplementary Instructions to Bidders - Sports Field Contractors

Division 01 – General Requirements

01 11 00 Summary of Work
01 22 00 Measurement and Payment
01 25 00 Substitution Procedures
01 29 73 Schedule of Values
01 32 16 Construction Schedules
01 32 33 Construction Videos and Photographs
01 33 00 Submittal Procedures
01 40 00 Quality Requirements
01 65 00 Product Delivery Requirements
01 71 15 Mobilization-Demobilization
01 71 23 Construction Staking
01 74 00 Cleaning and Waste Management
01 78 23 Operation and Maintenance Data
01 78 36 Warranties

Division 02 – Existing Conditions

02 41 00 Demolition

Division 03 – Concrete

03 10 00 Concrete Forming and Accessories
03 20 00 Concrete Reinforcing
03 30 00 Cast in Place Concrete

Division 04 – Masonry

04 05 11 Masonry Mortaring and Grouting
04 20 00 Masonry

Division 05 – Metals

05 12 00 Structural Steel Framing
05 50 00 Metal Fabrications

Division 06 – Wood, Plastics and Composites

06 10 00 Rough Carpentry
06 17 63 Shop Fabricated Wood Trusses

Division 07 – Thermal and Moisture Protection

07 41 13.16	Standing-Seam Metal Roof Panels
07 46 46	Fiber-Cement Siding
07 92 00	Joint Sealants

Division 08 – Openings

08 11 13	Hollow Metal Doors and Frames
08 31 13	Access Doors and Frames
08 33 23	Overhead Coiling Doors
08 51 13	Aluminum Windows
08 71 00	Door Hardware
08 80 00	Glazing
08 83 00	Mirrors

Division 09 – Finishes

09 29 00	Gypsum Board
09 30 13	Ceramic Tiling
09 65 13	Resilient Base and Accessories
09 91 13	Exterior Painting
09 91 23	Interior Painting

Division 10 – Specialties

10 14 19	Dimensional Letter Signage
10 21 13.17	Phenolic-Core Toilet Compartments
10 28 00	Toilet, Bath, And Laundry Accessories
10 44 13	Fire Protection Cabinets
10 44 16	Fire Extinguishers

Division 22 – Plumbing

22 11 01	Water Distribution System
22 11 17	Reclaimed Water and Accessories
22 13 13	Sewer Collection System
22 13 13.13	Sewage Force Main System
22 13 33	Grinder Pump Station
22 14 13	Storm Drainage Utilities

Division 23 – Heating, Ventilating, and Air Conditioning (HVAC)

23 00 00	Conditions for Mechanical Systems (HVAC And Plumbing)
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Division 26 – Electrical

26 00 00	General Electrical
26 05 19	Conductors
26 05 26	Grounding
26 05 33	Raceways and Boxes
26 05 43	Service Entrance (Underground)

26 22 13	General Lighting and Distribution Transformers
26 24 16	Panelboards
26 26 16	Safety Switches and Circuit Breakers
26 27 26	Wiring Devices
26 51 00	Lighting Fixtures
26 55 68	Sports Field Lighting

Division 27 – Communications

27 10 00	Data Communications
27 30 00	Data Com and Cable TV Raceway Systems

Division 31 – Earthwork

31 11 00	Clearing and Grubbing
31 20 00	Earth Moving
31 23 16	Excavation
31 23 19	Dewatering
31 23 23	Fill and Backfill
31 23 33	Trenching and Backfilling
31 31 16	Termite Control

Division 32 – Exterior Improvements

32 16 00	Concrete Sidewalks and Curbs and Gutters
32 17 13	Parking Bumpers
32 17 23	Pavement Markings
32 31 13.10	PVC Coated Galvanized Chain Link Fences and Gates
32 84 00.01	Irrigation Systems
32 90 01	Sportsfield Construction and Laser Grading
32 91 13.19	Planting Soils
32 92 00	Lawns and Grasses
32 93 00	Trees Plants and Ground Covers

Division 33 – Utilities

33 05 07.13	Horizontal Directional Drilling
33 05 61	Manholes and Covers

Supplementary Instructions to Bidders - Sports Field Contractors

1.1 General

- A. Qualification of Sports Field Contractors (SFC): Owner desires that the work associated with the construction of the 6 athletic fields be performed by contractor with extensive experience with construction of same.
- B. Required scope of work to be performed by the SFC on this project shall include grading of subgrade to one-half inch of specified elevations, installation of underground irrigation systems, placement of topsoil, soil amendments, finish grading of the sports fields using laser grading technology to one-quarter inch of specified elevations, installation of infield material and sodding of the fields. A SFC must perform this work with their own forces. Irrigation installation may be subcontracted but must be performed under the supervision of the SFC. Placement of topsoil in the outfields may be accomplished by the general or earthwork contractor under the supervision of the SFC to ensure the proper specified depth of topsoil.
- C. Bidders shall identify the SFC they will use in their bid on the Bid Form. Failure to identify a qualified SFC may result in the bid being deemed non-responsive and therefore rejected.

1.2 Qualification

- A. The SFC must be able to demonstrate that they have experience with multiple projects similar in scope to this project that have been completed within the last three consecutive years. This project includes a natural turf baseball fields(6) with in-field. Said project(s) shall be of similar scope and character with the work to be performed and have been performed by and only by the actual SFC. Further, prior work performed as a subcontractor involving only part of direct field construction on such previous projects shall not be considered. For example, contractors whose primary experience only involves the installation of sod on athletic fields shall not be considered as SFC's.
 - 1. The SFC must have an on-site construction superintendent having at least three years' experience constructing athletic fields using laser grading systems and with the installation of natural turf fields.
 - 2. The SFC must perform all required work with their own staff supervision and employees, using company equipment either owned or leased without the subcontracting of any of the said required work, except the SFC may be allowed to subcontract 1) irrigation, 2) grow-in maintenance (if required), as long as the SFC directly controls and supervises the subcontractor(s).
 - 3. SFC must have experience with automatically controlled laser guided grading equipment, specifically a dual slope hydraulically actuated soil plane adjustable to 1/100 of a foot. Equipment shall be pulled with a high flotation tractor with a gross weight of less than 15,000 lbs. Equipment must be made available for inspection by the Owner if requested. The contractor SFC shall

also use other specialized sports field equipment such as tractors, disc harrows, power rakes, tillers, infield groomers and drags in construction of athletic fields.

4. The Owner may make minor exceptions to the minimum qualifications if deemed in the Owner's best interests to do so.
5. The following information must be submitted in order to be considered as a qualified SFC: A completed copy of the attached "Statement of Qualifications".
6. The following information for each of the projects required under Item 1 and 4 in the minimum qualifications set forth above:
 - Project Name and Location
 - Project Description
 - Owner's Name
 - Owner's Complete Address
 - Owner's Telephone Area Code and Number
 - Owner's Current Contact Person
7. A listing of laser technology and equipment plus other specialized sports field construction equipment owned and/or leased.
8. Resumes or other evidence of the experience of the principals of the firm and for the project superintendent proposed for this project.
9. Any other information concerning the SFC that evidences your ability to meet the minimum qualifications necessary for the project.
10. The decision on whether an SFC is qualified rests solely with the Owner. Determination of meeting such requirements will be at the discretion of the Owner based on the information submitted and interviews of owners of previous projects completed by the SFC, financial stability, and equipment available to accomplish the task, experience of labor force and any other pertinent information the Owner requires to determine qualified sports field contractors.

**STATEMENT OF QUALIFICATIONS
SPORTS FIELD CONTRACTOR**

Provide clear and comprehensive responses to all questions and requested information below. If necessary, questions may be answered on separate attached sheets. The Bidder may submit any additional information desired to demonstrate their qualifications.

11. Name of Sports Field Contractor's Company:
12. Permanent main office address, phone and email and (if available) web site address:
13. When organized:
14. If a Corporation, where incorporated:
15. How many years have you been engaged in the contracting business under your present firm or trade name?
16. Contracts on hand: (Schedule these, showing the name of the project, the Owner, amount of each contract and the appropriate anticipated dates of completion):
17. Provide the company's gross revenues for sports field construction only for the past three years (this information will remain confidential):
2023_____ 2022_____ 2021_____
18. General description of work performed by your company:
19. Have you ever failed to complete any work awarded to you? If so, where and why.
20. Have you ever defaulted on a contract? If so, where and why.

The undersigned hereby authorizes and requests any person, firm, or corporation to furnish any information requested in verification of the recitals comprising this Statement of Qualifications.

Dated this _____ day of _____, 20_____.

Sports Field Contractor:

Company Name: _____

By (Signature): _____

Printed Name: _____

Title: _____

END OF SECTION

Part 1 General

1.1 Section Includes

- A. Work by Contractor.
- B. Work by Owner.
- C. Work by Others.
- D. Owner-Furnished Items
- E. Contractor Use of Site and Premises
- F. Future Work
- G. Owner Occupancy
- H. Quantities

1.2 Work by Contractor

- A. The work to be performed under this Contract shall consist of furnishing all labor, materials, tools, equipment and incidentals and performing all work required to construct complete in place and ready to operate the improvements shown in the Contract Documents. These improvements include, but are not limited to, the following:
 - 1. The Southport Sports Complex consists of construction of seven baseball fields and various components to support the complex. The bid package consists of all activities required for, and incidental to, the construction of the proposed improvements. Improvements include but are not limited to a new turn lane on highway 77, asphalt entry drive, entry gates, parking lots, erosion and sediment control, grading, sewer force main, domestic water, reuse water for irrigation, ballfield fencing, athletic field construction, laser grading, irrigation, sports field lighting, parking lot lighting, site electrical, concession/restroom building, maintenance building, covered batting cages, picnic pavilion, concrete walks, asphalt walks, landscaping, and other items incidental to the sports complex described in the project drawings and specifications.
- B. All work described above shall be performed as shown on the Drawings and as specified. For any conflicts between Drawings and Technical Specifications, the Drawings shall govern.
- C. Project Location

1. The equipment and materials to be furnished will be installed at the locations shown on the Drawings.

1.3 Owner Furnished Items

A. Products furnished to the site and paid for by Owner:

1. Site and ballfield furnishings as described in materials schedule on sheet L7.01 .
2. Site and Sports Field lighting as described on electrical drawings and specifications.

B. Owner's Responsibilities:

1. Arrange for and deliver Owner-reviewed shop drawings, product data, and samples to Contractor.
2. Arrange and pay for product delivery to site.
3. On delivery, inspect products jointly with Contractor.
4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
5. Arrange for manufacturers' warranties, inspections and service.

C. Contractor's Responsibilities:

1. Review Owner-reviewed shop drawings, product data, and samples.
2. Receive and unload products at site; inspect for completeness or damage, jointly with Owner.
3. Handle, store, install and finish products.
4. Repair or replace items damaged after receipt.

1.4 Quantities

- A. The Owner reserves the right to alter the quantities of work to be performed or to extend or shorten the improvements at any time when and as found necessary, and the Contractor shall perform the work as altered, increased or decreased. Payment for such increased or decreased quantity will be made in accordance with the Instructions to Bidders. No allowance will be made for any change in anticipated profits nor shall such changes be considered as waiving or invalidating any conditions or provisions of the Contract and Bond.

Part 2 Products
(NOT USED)

Part 3 Execution
(NOT USED)

END OF SECTION

Part 1 General

1.1 Scope

- A. The Bid lists each item of the Project for which payment will be made. No payment will be made for any items other than those listed in the Bid.
- B. Required items of work and incidentals necessary for the satisfactory completion of the work which are not specifically listed in the Bid, and which are not specified in this Section to be measured or to be included in one of the items listed in the Bid, shall be considered as incidental to the work. All costs thereof, including Contractor's overhead costs and profit, shall be considered as included in the lump sum for the various Bid items. The Contractor shall prepare the Bid accordingly.
- C. Work includes furnishing all plant, labor, equipment, tools and materials, which are not furnished by the Owner and performing all operations required to complete the work satisfactorily in place as specified and as indicated on the Drawings.

1.2 Descriptions

- A. Measurement and payment shall be on the lump sum price bid in accordance with the schedule of values submitted by the contractor upon award of the project as described in Section 01 29 73. Payment will include all necessary and incidental related work not shown to be included in any other item of work listed in the Bid.
- B. Unless otherwise stated in individual sections of the Specifications or in the Bid, no separate payment will be made for any item of work, materials, parts, equipment, supplies or related items required to perform and complete the work. The costs for all such items required shall be included in the price bid for item of which it is a part.
- C. Price and payment shall constitute full compensation to the Contractor for furnishing all plant, labor, equipment, tools and materials not furnished by the Owner and for performing all operations required to provide to the Owner the entire Project complete in place as specified and as indicated on the Drawings.
- D. "Products" shall mean materials or equipment permanently incorporated into the work.

1.3 Base Bid

- A. Work under this item shall include furnishing all products, materials and equipment and performing all labor necessary to complete and put into operation the Southport Sports Complex, including all work shown on the Drawings and/or specified that is not included in the additive alternates.
- B. Irrigation under this line item should include water service, main line, pump station, controller, valves, wiring, heads, piping and misc. irrigation components not

identified in Alternate line items. Irrigation components in base bid price are to be based on components required for a domestic water supply.

- C. Sports Field Lighting equipment for the project is being purchased directly from MUSCO lighting by Bay County. Base bid for lighting should include coordination and installation of lighting as described in the documents.
- D. Measurement and payment shall be based on the lump sum price bid in accordance with the schedule of values submitted by the contractor upon award of the project as described in Section 01 29 73.

1.4 Alternate No. 1 – Fields 5 & 6

- A. Work under this item shall include all labor, equipment, materials, and incidentals necessary for furnishing all products, materials and equipment and performing all labor necessary to complete construction of all the proposed improvements in the northern portion of the site as noted on drawings to include but not limited to concrete sidewalks and plaza areas adjacent to Fields 5 & 6 and batting cages; picnic shelter, batting cages, Fields 5 & 6 including sports field construction, lighting, fencing backstops, dugouts, irrigation, landscaping, laser/ finish grading and all other items incidental to construction of noted items and as shown on drawing sheets _C1.04, C2.04, L3.04, IR-2. .
- B. Measurement and payment shall be based on the lump sum price for Alternate No. 1 in accordance with the schedule of values submitted by the contractor upon award of the project as described in Section 01 29 73.

1.5 Alternate No. 2 – Reclaimed Irrigation System

- A. Work under this item shall include the furnishing all products, materials and equipment and performing all labor necessary to provide proposed irrigation system to include all irrigation components, valves, wiring, and lateral lines for designated zones in the landscaped areas outside fields 1-4. Additional costs associated with reclaimed water irrigation components compared to domestic water irrigation equipment is also to be included in the price for Alternate No. 2. .
- B. Measurement and payment shall be based on the lump sum price bid for Alternate No. 2 in accordance with the schedule of values submitted by the contractor upon award of the project as described in Section 01 29 73. .

Part 2 Products

(NOT USED)

Part 3 Execution

(NOT USED)

END OF SECTION

Part 1 General

1.1 Scope

- A. This section outlines the restrictions and requirements for substitutions, product and manufacturer options, and construction method options.

1.2 Definitions

- A. For the purposes of these Contract Documents, a “substitute item” shall be defined as one of the following:
 - 1. A product or manufacturer offered as a replacement to a specified product or manufacturer.
 - 2. A product or manufacturer offered in addition to a specified product or manufacturer.
- B. For the purposes of these Contract Documents, a “substitute construction method” shall be defined as one of the following:
 - 1. A mean, method, technique, sequence or procedure of construction offered as a replacement for a specified mean, method, technique, sequence or procedure of construction.
 - 2. A mean, method, technique, sequence or procedure of construction offered in addition to a specified mean, method, technique, sequence or procedure of construction.

1.3 General

- A. An item or construction method, which is offered where no specific product, manufacturer, mean, method, technique, sequence or procedure of construction is specified or shown on the Drawings, shall not be considered a substitute and shall be at the option of the Contractor, subject to the provisions in the Contract Documents for that item or construction method.
- B. For products specified only by a referenced standard, the Contractor may select any product by any manufacturer, which meets the requirements of the Specifications, unless indicated otherwise in the Contract Documents.
- C. If the manufacturer is named on the Drawings or in the Specifications as an acceptable manufacturer, products of that manufacturer meeting all requirements of the Specifications and Drawings are acceptable.
- D. Whenever the Engineer's design is based on a specific product of a particular manufacturer, that manufacturer will be shown on the Drawings and/or listed first in the list of approved manufacturers in the Specifications. Any Bidder intending to

furnish products of other than the first listed manufacturer, or furnish substitute items, shall:

1. Verify that the item being furnished will fit in the space allowed, perform the same functions and have the same capabilities as the item specified,
2. Include in its Bid the cost of all accessory items which may be required by the other listed substitute product,
3. Include the cost of any architectural, structural, mechanical, piping, electrical or other modifications required, and
4. Include the cost of required additional work by the Engineer, if any, to accommodate the item.

1.4 Approvals

- A. Approval, of a substitution as an acceptable manufacturer, of the Engineer is dependent on determination that the product offered is essentially equal in function, performance, quality of manufacture, ease of maintenance, reliability, service life and other criteria to that on which the design is based; and will require no major modifications to structures, electrical systems, control systems or piping systems.

1.5 Substitutions and Options

- A. After Notice to Proceed
 1. Substitute items will be considered only if the term "equal to" precedes the names of acceptable manufacturers in the Specification.
 2. Where items are specified by referenced standard or specified as indicated in Article 1.3, Paragraph B above, such items shall be submitted to the Engineer for review.
 3. The Contractor shall submit shop drawings on the substitute item for the Engineer's review in accordance with Section 01 33 00.
 4. No substitutions will be considered for the manufacturers listed in the Bid.
- B. Prior to Opening of Bids
 1. No consideration or approvals will be made for products specified by a referenced standard, or specified as indicated in Article 1.3, Paragraph B, above. Such consideration may occur only after the Notice to Proceed.
 2. No consideration or approvals will be made for products being offered where the term "equal to" precedes the name of an approved product. Such substitution consideration may occur only after the Notice to Proceed.

3. If the term “or equal” follows the names of acceptable manufacturers, then other manufacturers desiring approval as an acceptable manufacturer may submit the product information to the Engineer for approval during the bidding phase, as indicated below. With the exception of where the phrase “no substitutions” is associated with a list of manufacturers, where a list of acceptable manufacturers is not preceded by the phrase “equal to”, the list of acceptable manufacturers shall be considered as having the phrase “or equal” following the list, and the list being subject to the “or equal” provisions of this section.
4. The manufacturer shall include the following items in its “or equal” submittal:
 - a. Descriptive literature including information on materials used, minimum design standards, standard design features, manufacturing processes and facilities, and similar information which will indicate experience and expertise in the manufacture of the product being evaluated.
 - b. Performance specifications applicable to the manufacturer's standard design which indicates the level of performance to be expected from the product.
 - c. A complete set of submittal drawings of similar products which have been completed and placed into operation.
 - d. A list of existing installations of products similar in type and size, information required to satisfy specified experience requirements, or a copy of the bond to be submitted in lieu of experience.
 - e. Evidence of technical ability of the manufacturer to design and manufacture products meeting Project requirements.
 - f. Evidence submitted shall include, as a minimum, descriptions of engineering and manufacturing staff capabilities.
 - g. A copy of the manufacturer's most recent annual business report. Include a statement comparing the present net worth of the manufacturer in comparison to the total value of all products proposed to be furnished. Net worth must exceed the total value of all products proposed.
 - h. A complete description of field service capabilities, including the location of field service facilities which would serve the proposed facility and the number and qualifications of personnel working from that location.
 - i. A complete list of all requirements of the Drawings and Specifications with which the manufacturer cannot conform, including reasons why alternate features are considered equivalent.
 - j. If descriptive literature or drawings illustrate standard products with design features or materials not in compliance with Project requirements

- then these exceptions must be specifically listed. Failure to do so will indicate intent by the manufacturer to modify design features and alter materials to meet Project requirements.
- k. Where additional information is submitted to supplement the submittal, all changes to the list of exceptions shall be specifically noted.
 - l. All other information necessary to fully evaluate the product for consideration.
5. This “or equal” submittal shall reach the Engineer no later than 15 days prior to the Bid date. Submittals which do not include a complete list of exceptions to Project requirements, or the statement “No exceptions to the Specifications will be taken”, will automatically be rejected by the Engineer. Manufacturers will be advised of approval or rejection in writing no later than 10 days prior to the Bid date. Rejected submittals may be supplemented with additional information and resubmitted no later than five days prior to the Bid date. Manufacturers making supplementary submittals will be advised of approval or rejection in writing no later than two days prior to the Bid date.
 6. Bids based on products which have not received the approval of the Engineer may be determined non-responsive by the Owner and rejected.

Part 2 Products

(NOT USED)

Part 3 Execution

(NOT USED)

END OF SECTION

Part 1 General

1.1 Scope

The work under this Section includes preparation and submittal of a schedule of values.

1.2 General

- A. Timing of Submittal: Submit to the Engineer, a schedule of values allocated to the various portions of the work, within 10 days after Notice to Proceed. The first progress payment will not be made until the next pay cycle following the Engineer's approval of the Contractor's values.
- B. Supporting Data: Upon request of the Engineer, support the values with data which will substantiate their correctness.
- C. Use of Schedule: The schedule of values, unless objected to by the Engineer, shall be used only as a basis of the Contractor's Application for Payment.

1.3 Form and Content of Schedule of Values

- A. Form and Identification
 - 1. Type schedule on 8-1/2 x 11-inch white paper.
 - 2. Contractor's standard forms and automated printout may be used.
 - 3. Identify schedule with:
 - a. Title of Project and location
 - b. Engineer
 - c. Name and address of Contractor
 - d. Contract designation
 - e. Date of submission
- B. Schedule shall list the installed value of the component parts of the work in sufficient detail to serve as a basis for computing values for progress payments during construction. Breakdown shall be by structure, then by CSI Format, for ease of field verification of quantities completed in each structure.

C. Format

1. Follow the Table of Contents of the Contract Documents as the format for listing the component items.
2. Identify each item with the number and title of the respective major section of the Specifications.

D. For each major line item list sub-values of major products or operations under the item.

E. For the Various Portions of the Work:

1. Each item shall include a directly proportional amount of the Contractor's overhead and profit.
2. For items on which progress payments will be requested for stored materials, break down the value into:
 - a. The cost of the materials, delivered and unloaded, with taxes paid.
 - b. The total installed value, including Contractor's overhead and profit, less item a. above.

F. The sum of all values listed in the schedule shall equal the Bid Total.

Part 2 Products

(NOT USED)

Part 3 Execution

(NOT USED)

END OF SECTION

Part 1 General

1.1 Scope

- A. Preparing, furnishing, distributing, and periodic updating of the construction schedules as specified herein.
- B. The purpose of the schedule is to demonstrate that the Contractor can complete the overall Project within the Contract Time and meet all required interim milestones.

1.2 Submittals

- A. Overall Project Schedule (OPS)
 - 1. Submit the schedule within 10 days after date of the Notice to Proceed.
 - 2. The Engineer will review the schedule and return it within 10 days after receipt.
 - 3. If required, resubmit within 10 days after receipt of a returned copy.
- B. Near Term Schedule (NTS)
 - 1. Submit the first Near Term Schedule within 10 days of the Notice to Proceed.
 - 2. The Engineer will review the schedule and return it within 10 days after receipt.
- C. Submit an update of the OPS and NTS with each progress payment request.
- D. Submit the number of copies required by the Contractor, plus four copies to be retained by the Engineer.

1.3 Approval

- A. Approval of the Contractor's detailed construction program and revisions thereto shall in no way relieve the Contractor of any of Contractor's duties and obligations under the Contract. Approval is limited to the format of the schedule and does not in any way indicate approval of, or concurrence with, the Contractor's means, methods and ability to carry out the work.

1.4 Overall Project Schedule (Ops)

- A. The Contractor shall submit to the Owner for approval a detailed Overall Project Schedule of the Contractor's proposed operations for the duration of the Project. The OPS shall be in the form of a Gantt/bar chart.
- B. Gantt/Bar Chart Schedule

1. Each activity with a duration of five or more days shall be identified by a separate bar. Activities with a duration of more than 20 days shall be subdivided into separate activities.
2. The schedule shall include activities for shop drawing preparation and review, fabrication, delivery, and installation of major or critical path materials and equipment items.
3. The schedule shall show the proposed start and completion date for each activity. A separate listing of activity start and stop dates and working day requirements shall be provided unless the information is shown in text form on the Gantt/bar chart.
4. The schedule shall identify the Notice to Proceed date, the Contract Completion date, major milestone dates, and a critical path.
5. The schedule shall be printed on a maximum 11 x 17-inch size paper. If the OPS needs to be shown on multiple sheets, a simplified, one page, summary bar chart showing the entire Project shall be provided.
6. The schedule shall have a horizontal time scale based on calendar days and shall identify the Monday of each week.
7. The schedule shall show the precedence relationship for each activity.

1.5 Near Term Schedule (NTS)

- A. The Contractor shall develop and refine a detailed Near Term Schedule showing the day to day activities with committed completion dates which must be performed during the upcoming 30-day period. The detailed schedule shall represent the Contractor's best approach to the Work which must be accomplished to maintain progress consistent with the Overall Project Schedule.
- B. The Near Term Schedule shall be in the form of Gantt/bar chart and shall include a written narrative description of all activities to be performed and describe corrective action to be taken for items that are behind schedule.

1.6 Updating

- A. Show all changes occurring since previous submission of the updated schedule.
- B. Indicate progress of each activity and show actual completion dates.
- C. The Contractor shall be prepared to provide a narrative report at the Progress Meetings. The report shall include the following:
 1. A description of the overall Project status and comparison to the OPS.
 2. Identify activities which are behind schedule and describe corrective action to be taken.

3. A description of changes or revisions to the Project and their effect on the OPS.
4. A description of the Near Term Schedule of the activities to be completed during the next 30 days. The report shall include a description of all activities requiring participation by the Engineer and/or Owner.

Part 2 Products

(NOT USED)

Part 3 Execution

(NOT USED)

END OF SECTION

Part 1 General

1.1 Scope

- A. The Contractor shall furnish all equipment and labor materials required to provide the Owner with digital construction videos and photographs of the Project. The requirements of this section are independent of and in addition to the requirements in Division 33 of the Specifications.
- B. Photo and video files shall become the property of the Owner and none of the videos or photographs shall be published without express permission of the Owner.

1.2 Pre And Post Construction Videos and Photographs

- A. Prior to the beginning of any work, the Contractor shall take videos and photographs of the work area to record existing conditions.
- B. Following completion of the work, another set of videos and photographs shall be made showing the same areas and features as in the pre-construction videos and photographs.
- C. All conditions which might later be subject to disagreement shall be shown in sufficient detail to provide a basis for decisions.

1.3 File Format, Media and Submittals

- A. Photographs shall be in “jpg” format.
- B. Videos shall be in a format viewable by Microsoft Windows Media Player or Apple QuickTime Player. Audio narration is desirable.
- C. Files shall be named such that what is being viewed is self evident.
- D. Files shall be submitted on a flash drive, compact disk (CD) or a digital video disk (DVD). If submitted on DVD, disk shall be recorded in “Minus R” format.
- E. The pre-construction videos and photographs shall be submitted to the Engineer within 25 calendar days after the date of receipt by the Contractor of Notice to Proceed. Post-construction videos and photographs shall be provided prior to final acceptance of the Project.

Part 2 Products

(NOT USED)

Part 3 Execution

(NOT USED)

END OF SECTION

Part 1 General

1.1 Scope

- A. The work under this Section includes submittal to the Engineer of shop drawings, product data and samples required by the various Sections of these Specifications.
- B. Submittal Contents: The submittal contents required are specified in each Section.
- C. Definitions: Submittals are categorized as follows:
 - 1. Shop Drawings
 - a. Shop drawings shall include technical data, drawings, diagrams, procedure and methodology, performance curves, schedules, templates, patterns, test reports, calculations, instructions, measurements and similar information as applicable to the specific item for which the shop drawing is prepared. Note- Several submittals require a professional engineer licensed in the State of Florida to provided required calculations and stamped drawings. See drawings for specifics.
 - b. Provide newly-prepared information with graphic information at accurate scale (except as otherwise indicated) with name or preparer (firm name) indicated. The Contract Drawings shall not be reproduced by any method for use as or in lieu of detail shop drawings. Show dimensions and note dimensions that are based on field measurement. Identify materials and products in the work shown. Indicate compliance with standards and special coordination requirements. Do not allow shop drawings to be used in connection with the Work without appropriate final "Action" markings by the Engineer.
 - c. Drawings shall be presented in a clear and thorough manner. Details shall be identified by reference to sheet and detail, Specification Section, schedule or room numbers shown on the Contract Drawings.
 - d. Minimum assembly drawings sheet size shall be 11 x 17-inches.
 - e. Minimum detail sheet size shall be 8-1/2 x 11-inches.
 - f. Minimum Scale:
 - 1) Assembly Drawings Sheet, Scale: 1-inch = 30 feet.
 - 2) Detail Sheet, Scale: 1/4-inch = 1 foot.
 - 2. Product Data

- a. Product data includes standard published information on materials, products and systems, not specially prepared for this Project, other than the designation of selections from among available choices printed therein.
 - b. Collect required data into one submittal for each unit of work or system, and mark each copy to show which choices and options are applicable to the Project. Include manufacturer's standard published recommendations for application and use, compliance with standards, application of labels and seals, notation of field measurements which have been checked and special coordination requirements.
3. Samples
- a. Samples include both fabricated and un-fabricated physical examples of materials, products and units of work, both as complete units and as smaller portions of units of work, either for limited visual inspection or, where indicated, for more detailed testing and analysis.
 - b. Provide units identical with final condition of proposed materials or products for the work. Include "range" samples, not less than three units, where unavoidable variations must be expected, and describe or identify variations between units of each set. Provide full set of optional samples where the Engineer's selection is required. Prepare samples to match the Engineer's sample where indicated. Include information with each sample to show generic description, source or product name and manufacturer, limitations and compliance with standards. Samples are submitted for review and confirmation of color, pattern, texture and "kind" by the Engineer. Engineer will note "test" samples, except as otherwise indicated, for other requirements, which are the exclusive responsibility of the Contractor.
4. Miscellaneous submittals related directly to the work (non-administrative) include warranties, maintenance agreements, workmanship bonds, project photographs, survey data and reports, physical work records, statements of applicability, quality testing and certifying reports, copies of industry standards, record drawings, field measurement data, operating and maintenance materials, overrun stock, security/protection/safety keys and similar information, devices and materials applicable to the work but not processed as shop drawings, product data or samples.

1.2 Specific Category Requirements

- A. General: Except as otherwise indicated in the individual work sections, comply with general requirements specified herein for each indicated category of submittal. Submittals shall contain:
 1. The date of submittal and the dates of any previous submittals.

2. The Project title.
3. Unless indicated otherwise by the Engineer's submittal management software, provide numerical submittal numbers, starting with 1.0, 2.0, etc. Revisions to be numbered 1.1, 1.2, etc.
4. The Names of:
 - a. Contractor
 - b. Supplier
 - c. Manufacturer
5. Identification of the product, with the Specification Section number, permanent equipment tag numbers and applicable Drawing No.
6. Field dimensions, clearly identified as such.
7. Relation to adjacent or critical features of the work or materials.
8. Applicable standards, such as ASTM .
9. Notification to the Engineer in writing, at time of submissions, of any deviations on the submittals from requirements of the Contract Documents.
10. Identification of revisions on resubmittals.
11. Contractor's stamp, initialed or signed or affirmatively indicated on submittal, certifying to review of submittal, verification of products, field measurements and field construction criteria and coordination of the information within the submittal with requirements of the work and of Contract Documents.
12. Submittals showing more than the particular item under consideration shall have all but the pertinent description of the item for which review is requested crossed out.

1.3 Routing of Submittals

- A. Submittals and routine correspondence shall be routed as follows:
 1. Supplier to Contractor (through representative if applicable)
 2. Contractor to Engineer
 3. Engineer to Contractor and Owner
 4. Contractor to Supplier

Part 2 Products

2.1 Shop Drawings

- A. Unless otherwise specifically directed by the Engineer, make all shop drawings accurately to a scale sufficiently large to show all pertinent features of the item and its method of connection to the work.
- B. Submit all shop assembly drawings, as a digital image, pdf format, scanned at the original scale.
- C. Submit all shop drawings as a digital image, pdf format, scanned at the original scale.
- D. Drawings requiring a professional engineer to prepare are to be stamped with seal of noted engineer.

2.2 Manufacturer's Literature

- A. Where content of submitted literature from manufacturers includes data not pertinent to this submittal, clearly indicate which portion of the contents is being submitted for the Engineer's review.

2.3 Samples

- A. Samples shall illustrate materials, equipment or workmanship and established standards by which completed work is judged.
- B. Unless otherwise specifically directed by the Engineer, all samples shall be of the precise article proposed to be furnished.
- C. Submit all samples in the quantity which is required to be returned plus one sample which will be retained by the Engineer.

2.4 Colors

- A. Unless the precise color and pattern is specifically described in the Contract Documents, wherever a choice of color or pattern is available in a specified product, submit accurate color charts and pattern charts to the Engineer for review and selection.
- B. Unless all available colors and patterns have identical costs and identical wearing capabilities, and are identically suited to the installation, completely describe the relative costs and capabilities of each.

Part 3 Execution

3.1 Contractor's Coordination of Submittals

- A. Prior to submittal for the Engineer's review, the Contractor shall use all means necessary to fully coordinate all material, including the following procedures:
 - 1. Determine and verify all field dimensions and conditions, catalog numbers and similar data.
 - 2. Coordinate as required with all trades and all public agencies involved.
 - 3. Submit a written statement of review and compliance with the requirements of all applicable technical Specifications as well as the requirements of this Section.
 - 4. Clearly indicate in a letter or memorandum on the manufacturer's or fabricator's letterhead, all deviations from the Contract Documents.
- B. Each and every shop drawing and data sheet submittal shall bear the Contractor's stamp showing that they have been so checked. Shop drawings submitted to the Engineer without the Contractor's stamp will be returned to the Contractor for conformance with this requirement.
- C. The Owner may backcharge the Contractor for costs associated with having to review a particular shop drawing, product data or sample more than two times to receive a "No Exceptions Taken" mark.
- D. Grouping of Submittals
 - 1. Unless otherwise specifically permitted by the Engineer, make all submittals in groups containing all associated items.
 - 2. No review will be given to partial submittals of shop drawings for items which interconnect and/or are interdependent. It is the Contractor's responsibility to assemble the shop drawings for all such interconnecting and/or interdependent items, check them and then make one submittal to the Engineer along with Contractor's comments as to compliance, non-compliance or features requiring special attention.
- E. Schedule of Submittals
 - 1. Within 30 days of Contract award and prior to any shop drawing submittal, the Contractor shall submit a schedule showing the estimated date of submittal and the desired approval date for each shop drawing anticipated. A reasonable period shall be scheduled for review and comments. Time lost due to unacceptable submittals shall be the Contractor's responsibility and some time allowance for resubmittal shall be provided. The schedule shall

provide for submittal of items which relate to one another to be submitted concurrently.

3.2 Timing of Submittals

- A. Make all submittals far enough in advance of scheduled dates for installation to provide all required time for reviews, for securing necessary approvals, for possible revision and resubmittal, and for placing orders and securing delivery.
- B. In scheduling, allow sufficient time for the Engineer's review following the receipt of the submittal.

3.3 Reviewed Shop Drawings

- A. Engineer Review
 - 1. Allow a minimum of 30 days for the Engineer's initial processing of each submittal requiring review and response, except allow longer periods where processing must be delayed for coordination with subsequent submittals. The Engineer will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination. Allow a minimum of two weeks for reprocessing each submittal. Advise the Engineer on each submittal as to whether processing time is critical to progress of the work, and therefore the work would be expedited if processing time could be foreshortened.
 - 2. Acceptable submittals without any comments will be marked "No Exceptions Taken".
 - 3. Submittals containing comments for clarification will be marked "Exceptions Noted".
 - 4. Submittals marked "Revise and Resubmit" must be revised to reflect required changes and the initial review procedure repeated.
 - 5. The "Rejected" notation is used to indicate products which are not acceptable. Upon return of a submittal so marked, the Contractor shall repeat the initial review procedure utilizing acceptable products.
- B. No work or products shall be installed without a drawing or submittal bearing the "No Exceptions Taken" notation. The Contractor shall maintain at the job site a complete set of shop drawings bearing the Engineer's stamp.
- C. Substitutions: In the event the Contractor obtains the Engineer's approval for the use of products other than those which are listed first in the Contract Documents, the Contractor shall, at the Contractor's own expense and using methods approved by the Engineer, make any changes to structures, piping and electrical work that may be necessary to accommodate these products.

- D. Use of the “No Exceptions Taken” notation on shop drawings or other submittals is general and shall not relieve the Contractor of the responsibility of furnishing products of the proper dimension, size, quality, quantity, materials and all performance characteristics, to efficiently perform the requirements and intent of the Contract Documents. The Engineer's review shall not relieve the Contractor of responsibility for errors of any kind on the shop drawings. Review is intended only to assure conformance with the design concept of the Project and compliance with the information given in the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site. The Contractor is also responsible for information that pertains solely to the fabrication processes or to the technique of construction and for the coordination of the work of all trades.

3.4 Resubmission Requirements

- A. Shop Drawings
 - 1. Revise initial Drawings as required and resubmit as specified for initial submittal, with the resubmittal number shown.
 - 2. Indicate on Drawings all changes which have been made other than those requested by the Engineer.
- B. Project Data and Samples: Resubmit new data and samples as specified for initial submittal, with the resubmittal number shown.

END OF SECTION

Part 1 General

1.01 Section Includes

- A. Control of installation.
- B. Tolerances.
- C. Testing and inspection services.

1.02 Reference Standards

- A. ASTM C 1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2009.
- B. ASTM D 3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2008.
- C. ASTM E 329 - Standard Specification for Agencies Engaged Construction Inspection and/or Testing; 2009.
- D. ASTM E 543 - Standard Specification for Agencies Performing Nondestructive Testing; 2009.

1.03 Submittals

- A. Testing Agency Qualifications:
 - 1. Prior to start of Work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
- B. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor. ALL TEST REPORTS SHALL HAVE A UNIQUE DESIGNATION.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.

- g. Type of test/inspection.
 - h. Date of test/inspection.
 - i. Results of test/inspection.
 - j. Conformance with Contract Documents.
- C. Manufacturer's Field Reports: Submit reports for Engineer's benefit as contract administrator or for Owner.
- 1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

1.04 Testing and Inspection Agencies

- A. Owner will employ and pay for services of an independent testing agency to perform other specified testing.

Part 2 Products

NOT USED

Part 3 Execution

3.01 Control of Installation

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have Work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 Tolerances

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.03 Testing and Inspection

- A. See individual specification sections for testing required.
- B. Testing Agency Duties:
 - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified standards.
 - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 4. Promptly notify Engineer and Contractor of observed irregularities or non-conformance of Work or products.
 - 5. Perform additional tests and inspections required by Engineer.
 - 6. Submit reports of all tests/inspections specified.
- C. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the Work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the Work. However, if Agency determines that deficiencies exist, the Engineer shall be notified immediately.
- D. Contractor Responsibilities:
 - 1. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.

Quality Requirements

2. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
 3. Notify Engineer and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
- E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Engineer.
- F. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

3.04 Defect Assessment

- A. Replace Work or portions of the Work not conforming to specified requirements.
- B. If, in the opinion of Engineer, it is not practical to remove and replace the Work, Engineer will direct an appropriate remedy or adjust payment.

END OF SECTION

Part 1 General

1.1 Scope

- A. The Contractor shall provide transportation of all equipment, materials and products furnished under these Contract Documents to the work site. In addition, the Contractor shall provide preparation for shipment, loading, unloading, handling and preparation for installation and all other work and incidental items necessary or convenient to the Contractor for the satisfactory prosecution and completion of the work.
- B. All equipment, materials and products damaged during transportation or handling shall be repaired or replaced by the Contractor at no additional cost to the Owner prior to being incorporated into the work.

1.2 Transportation

- A. All equipment shall be suitably boxed, crated or otherwise protected during transportation.
- B. Where equipment will be installed using existing cranes or hoisting equipment, the Contractor shall ensure that the weights of the assembled sections do not exceed the capacity of the cranes or hoisting equipment.
- C. Small items and appurtenances such as gauges, valves, switches, instruments and probes which could be damaged during shipment shall be removed from the equipment prior to shipment, packaged and shipped separately. All openings shall be plugged or sealed to prevent the entrance of water or dirt.

1.3 Handling

- A. All equipment, materials and products shall be carefully handled to prevent damage or excessive deflections during unloading or transportation.
- B. Lifting and handling drawings and instructions furnished by the manufacturer or supplier shall be strictly followed. Eyebolts or lifting lugs furnished on the equipment shall be used in handling the equipment. Spreader bars or lifting beams shall be used when the distance between lifting points exceeds that permitted by standard industry practice.
- C. Under no circumstances shall equipment or products such as pipe, structural steel, castings, reinforcement, lumber, piles, poles, etc., be thrown or rolled off of trucks onto the ground.
- D. Slings and chains shall be padded as required to prevent damage to protective coatings and finishes.

Part 2 Products

(NOT USED)

Part 3 Execution

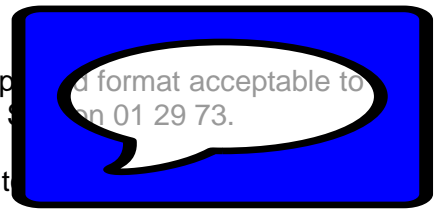
(NOT USED)

END OF SECTION

Part 1 General

1.1 Definition and Scope

- A. As required for the proper performance and completion of the Work, mobilization shall include, but not be limited to, the following principal items:
 - 1. Move onto the site all CONTRACTOR'S plant and equipment required for the first month's operation.
 - 2. Install temporary construction power, wiring, telephone, and lighting facilities.
 - 3. Establish a fire protection plan and safety program.
 - 4. Secure construction water supply.
 - 5. Provide field office trailers for CONTRACTOR and PROJECT REPRESENTATIVE.
 - 6. Provide on-site sanitary facilities and potable water facilities.
 - 7. Arrange for and erect CONTRACTOR'S lay down and storage yard and employee's parking facilities.
 - 8. Submit all required insurance certificates and bonds.
 - 9. Obtain all required permits.
 - 10. Post all OSHA, FDEP, Department of Labor, and all other required notices.
 - 11. Have CONTRACTOR'S project manager and/or superintendent at the job site full time.
 - 12. Submit a detailed construction schedule acceptable to the PROJECT REPRESENTATIVE.
 - 13. Submit a Schedule of Values of the Work in an approved format acceptable to the PROJECT REPRESENTATIVE as required by Section 01 29 73.
 - 14. Submit a hurricane preparedness plan acceptable to the PROJECT REPRESENTATIVE.
 - 15. Erect all required Project signs.



1.2 Payment for Mobilization

- A. No separate payment will be made for mobilization/ demobilization work and the cost of said manual shall be included in the Contract Price.

- B. Payment for all mobilization/demobilization work will be made in accordance with the approved schedule of values submitted by the CONTRACTOR upon award of the contract as required by Section 01 29 73 for mobilization and demobilization of all labor, equipment, materials and appurtenances necessary for construction of the project. Mobilization shall include all items listed in the above paragraph. Also included, but not limited to, as part of this bid item is the cost for project performance indemnification's, shop drawings, working drawings, schedules, record drawings and documents, coordination, and phasing and other miscellaneous items associated with the work. Measurement and payment for this bid item will be lump sum in accordance with the approved schedule of values. The lump sum price for mobilization/demobilization will be limited to 1.5 percent of the total contract amount. Eighty percent (80%) of the lump sum amount will be payable upon mobilization. The remaining 20% will be payable upon demobilization.

Part 2 Products

(Not Applicable)

Part 3 Execution

(Not Applicable)

END OF SECTION

Part 1 General

1.1 Scope

- A. Construction staking shall include all of the surveying work required to layout the Work and control the location of the finished Project. The Contractor shall have the full responsibility for constructing the Project to the correct horizontal and vertical alignment, as shown on the Drawings, as specified, or as ordered by the Owner. The Contractor shall assume all costs associated with rectifying work constructed in the wrong location.
- B. From the information shown on the Drawings and the information to be provided as indicated under Project Conditions below, the Contractor shall:
 - 1. Be responsible for setting reference points and/or offsets, establishment of baselines, and all other layout, staking, and all other surveying required for the construction of the Project.
 - 2. Safeguard all reference points, stakes, grade marks, horizontal and vertical control points, and shall bear the cost of re-establishing same if disturbed.
 - 3. Stake out the permanent and temporary easements or the limits of construction to ensure that the Work is not deviating from the indicated limits.
 - 4. Be responsible for all damage done to reference points, baselines, center lines and temporary benchmarks, and shall be responsible for the cost of re-establishment of reference points, baselines, center lines and temporary benchmarks as a result of the operations.
- C. Baselines shall be defined as the line to which the location of the Work is referenced, i.e., edge of pavement, road centerline, property line, right-of-way or survey line.
- D. Final record drawings shall be performed by and sealed by a licensed Professional Land Surveyor in the state of Florida.

1.2 Project Conditions

- A. The Drawings provide the location and/or coordinates of principal components of the Project. All coordinates are displayed in surface values. The alignment of some components of the Project may be indicated in the Specifications. The Owner may order changes to the location of some of the components of the Project or provide clarification to questions regarding the correct alignment.
- B. The survey points, control points, and baseline to be provided to the Contractor shall be limited to only that information which can be found on the Project site by the Contractor.

C. The Owner will provide the following:

1. One vertical control point on the Project site with its elevation.
2. Survey control monuments shall be installed in accordance with the detail shown on the plans.

1.3 Quality Assurance

- A. The Contractor shall furnish documentation, prepared by a surveyor currently registered in the State of Florida, confirming that staking is being done to the horizontal and vertical alignment shown in the Contract Documents. This requires that the Contractor hire, at the Contractor's own expense, a currently registered surveyor, acceptable to the Owner, to provide ongoing construction staking or confirmation of such.
- B. Any deviations from the Drawings shall be confirmed by the Owner prior to construction of that portion of the Project.

1.4 Site Work

- A. Staking Precision: The precision of construction staking shall match the precision of a component's location indicated on the Drawings. Staking of utilities shall be done in accordance with generally accepted practice for the type of utility.
- B. Paved Surfaces: The Contractor shall establish a reference point for establishing and verifying the paving subgrade and finished grade elevations. Any variance with plan grades shall be identified by the Contractor and confirmed by the Engineer prior to constructing the base.

Part 2 Products

(NOT USED)

Part 3 Execution

(NOT USED)

END OF SECTION

Part 1 General

1.1 Work Included

- A. Section includes requirements for cleanup, re-stabilization, restoration, and disposal to maintain a safe and well-kept job site and properly repair disturbed areas.

1.2 Quality Assurance

- A. Daily, and more often if necessary, conduct inspections verifying that requirements of cleanliness are being met.
- B. In addition to the standards described in this Section, comply with all pertinent requirements of governmental agencies having jurisdiction.

1.3 Cleaning Materials and Equipment

- A. Provide all required personnel, equipment and materials needed to maintain the specified standard of cleanliness.
- B. Use only the cleaning materials, methods and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material or as approved by the Engineer.

1.4 Cleaning During Construction

- A. (For Interior Areas) Proceed with construction cleanup concurrently with construction progress.
 - 1. Remove mud, oil, grease, soil, gravel, trash, scrap, debris, and excess materials that are unsightly or may cause accidents to persons or properties.
 - 2. Remove water from floor areas where electrical power tools are to be used and prevent stains on concrete that will be exposed in finish work.
 - 3. Select and employ cleaning materials and equipment with care to avoid scratching, marring, defacing, staining, or discoloring surfaces cleaned.
- B. (For Exterior Areas) Throughout all phases of construction, including suspension of work, and until the Final Acceptance, the Contractor shall keep the site clean and free from rubbish and debris. The Contractor shall also abate dust nuisance by cleaning, sweeping and sprinkling with water, or other means as necessary. The use of water resulting in mud on driveways, parking lots or streets will not be permitted as a substitute for sweeping or other methods.
 - 1. The road(s) on the construction site shall be paved immediately after the installation of underground utilities and the construction and underground/final

inspection of storm drainage, curbs, and gutters. The exit road on the construction site shall be paved first.

2. Vehicles exiting the construction site shall have all dirt clods and mud removed from their tires.
 3. Materials and equipment shall be removed from the site as soon as they are no longer necessary. Before the final inspection, the site shall be cleared of equipment, unused materials and rubbish so as to present a satisfactory clean and neat appearance. All cleanup costs shall be included in the Contractor's Bid.
 4. Care shall be taken to prevent spillage on haul routes. Any such spillage shall be removed immediately, and the area cleaned.
 5. Excess excavated material from catch basins or similar structures shall be removed from the site immediately. Sufficient material may remain for use as backfill if permitted by the Specifications. Forms and form lumber shall be removed from the site as soon as practicable after stripping.
- C. Failure of the Contractor to comply with the Engineer's cleanup orders may result in an order to suspend work until the condition is corrected. No additional compensation will be allowed as a result of such suspension.

1.5 Final Cleaning

- A. Upon completion of the work, the Contractor shall remove from the site all plant, materials, tools and equipment belonging to him, and leave the site with an appearance acceptable to the Owner.
- B. Thoroughly clean all equipment and materials installed and deliver over such materials and equipment in a bright, clean, polished and new appearing condition.
- C. Restore or replace all landscape features scarred or damaged by the Contractor's equipment or operations as nearly as possible to original condition, at the Contractor's expense. The Owner will approve the method of restoration to be used.
- D. The Contractor shall remove all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, or any other vestiges of construction, as directed by the Owner. It is anticipated that excavation, filling and plowing of roadways will be required to restore the area to near natural conditions which will permit the growth of vegetation thereon. The restored areas shall be filled, graded, and spread with sufficient topsoil to provide a minimum depth of four inches of suitable soil for the growth of grass, and the entire area shall be seeded or sodded with the original type of grass. Areas shall be restored to original contours as shown on the Plans. If the Plans do not cover the specific areas to be restored, the areas shall be graded to drain and give a smooth transition to the surroundings.

1.6 Measurement and Payment

- A. No separate payment will be made for any items of work, materials, parts, equipment, supplies, or related items required to perform and complete the requirements of this section. The costs for all such items required shall be considered subsidiary to other items of this Contract and shall not be paid for separately.

Part 2 Products

(NOT USED)

Part 3 Execution

(NOT USED)

END OF SECTION

Part 1 General

1.1 Section Includes

- A. Operations and Maintenance Manuals containing operating and maintenance data to enable operators and plant engineers to correctly operate, service and maintain all equipment and accessories covered by the Specifications and Drawings. The data contained in the manual shall explain and illustrate clearly and simply all principles and theory of operation, operating instructions, maintenance procedures, calibration procedures and safety precautions and procedures for the equipment involved.
- B. No separate payment will be made for the Operating and Maintenance Manual and the cost of said manual shall be included in the Contract Price.

1.2 Submittal Schedule

- A. The Contractor shall submit, for the Engineer's approval, two preliminary copies of the manual with all specified material before the work covered by these Contract Documents is 80 percent complete. The Engineer will notify the Contractor, in writing, of any deficiencies in the manual and will return one copy of the manual for completion and/or correction.
- B. Before Substantial Completion, the Contractor shall submit five copies of the revised manual, complete in detail as specified below.

1.3 Submittal Requirements

- A. The Contractor shall provide five copies of a complete and comprehensive reference manual (Operating and Maintenance Manual). Each set shall be assembled in one or more loose leaf, 8-1/2 x 11 inch 3 D side ring hardback binders, with transparent vinyl pocket front cover suitable for inserting identifying cover and with a transparent vinyl pocket on the spine for label. Binders shall be labeled Vol. 1, Vol. 2, etc., where more than one is required.
- B. The cover and binding edge of each manual shall have "Operations and Maintenance Instructions", the project title, specification section number and title, and subject matter of binder (when multiple binders are required) printed thereon, all as approved by the Engineer.
- C. Each copy of the manual shall be assembled with title page, typed table of contents, typed list of tables, and typed list of figures. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with reinforced holes and tab titling clearly printed under reinforced laminated plastic index tabs. All data shall be punched for binding. Composition and printing shall be arranged so that punching does not obliterate any data.

- D. Contents: Prepare a Table of Contents for the entire manual, identified by volume number, in each binder, with each Product or system description identified, print on 30 pound white paper.
- E. All copies of shop drawings, figures and diagrams shall be reduced to either 8-1/2 x 11-inches or to 11-inches in the vertical dimension and as near as practical to 17-inches in the horizontal dimensions. Such sheets shall be folded to 8-1/2 x 11-inches. The manual and other data shall be printed on first quality paper, 8-1/2 x 11-inch size with standard 3-hole punching. Text, figures and drawings shall be clearly legible and suitable for dry process reproductions.
- F. Each submittal shall have a cover sheet that includes the following information:
 - 1. The date of submittal and the dates of any previous submittals.
 - 2. The Project title.
 - 3. Numerical submittal numbers, starting with 1.90, 2.90, etc. Revisions to be numbered 1.91, 1.92, etc.
 - 4. The names of:
 - a. Contractor
 - b. Supplier
 - c. Manufacturer
 - 5. Identification of the product, with the Specification Section number, permanent equipment tag numbers and applicable Drawing No.
- G. The Engineer will not recommend final acceptance of the work until the Operating and Maintenance Manual is complete and satisfactory to Engineer.

1.4 Contents of Operating And Maintenance Manual

- A. Each manual shall include a title page which includes all information specified in Article 1.3, paragraph B of this Section. In addition, the title page shall include manufacturer's address, phone number, facsimile number, and contact; manufacturer's equipment name and model number; supplier's address, phone number, facsimile number, and contact.
- B. Each manual shall include a table of contents identifying the location of each item listed below, for each component supplied. For items not applicable to a component, the table of contents shall list N/A for the page number.
- C. For all equipment, the Contractor shall furnish a complete, detailed listing of all equipment, components and accessories showing component name, manufacturer, model number and quantity information shall be furnished for each component as outlined below:

1. Equipment function, normal operating characteristics, performance data and limiting conditions.
2. Detailed disassembly, overhaul and reassembly, installation, alignment, adjustment and checking instructions.
3. Detailed operating instructions for start-up, calibration, routine and normal operation, regulation and control, safety, shutdown and emergency conditions.
4. Detailed list of settings for relays, pressure switches, temperature switches, level switches, thermostats, alarms, relief valves, rupture discs, etc.
5. Detailed preventative maintenance procedures and schedules, including detailed lubrication instructions and schedules, identification of required lubricants and operating fluids (description, specification and trade name of at least two manufacturers), and diagrams illustrating lubrication points.
6. Detailed guide to "troubleshooting".
7. Detailed parts lists identified by title, materials of construction, manufacturer's part number, list of recommended spare parts identified as specified above, predicted life of parts subject to wear, and an exploded or concise cut-away view of each equipment assembly.
8. Electrical and instrumentation schematics, including motor control centers, control panels, instrument panels and analyzer panels.
9. List of all special tools supplied and description of their use. Special tools include any tool not normally available in an industrial hardware or mill supply house.
10. List of names and addresses of nearest service centers for parts, overhaul and service.
11. Procedures for storing, handling and disposing of any chemicals or products used with the equipment or system.
12. The supplier's operation and maintenance information will address the particular equipment furnished, with specific details on operation and maintenance practices. General data is not acceptable. Information contained in the manual which is not acceptable to the Project shall be marked out and noted as "N/A".

Part 2 Products

(NOT USED)

Part 3 Execution

(NOT USED)

END OF SECTION

Part 1 General

1.1 Project Maintenance and Warranty

- A. Maintain and keep in good repair the work covered by these Drawings and Specifications until acceptance by the Owner.
- B. The Contractor shall warrant all work for a period of time as stated in the General Conditions. The Owner will give notice of observed defects with reasonable promptness.
- C. The Contractor shall not be obligated to make replacements which become necessary because of ordinary wear and tear, or as a result of improper operation or maintenance, or as a result of improper work or damage by another Contractor or the Owner, or to perform any work which is normally performed by a maintenance crew during operation.
- D. In the event of multiple failures of major consequences prior to the expiration of the Correction Period described in the General Conditions, the affected unit shall be disassembled, inspected and modified or replaced as necessary to prevent further occurrences. All related components which may have been damaged or rendered non-serviceable as a consequence of the failure shall be replaced. A new warranty and Correction Period, as described in the General Conditions, against defective or deficient design, workmanship, and materials shall commence on the day that the item is reassembled and placed back into operation. As used herein, multiple failure shall be interpreted to mean two or more successive failures of the same kind in the same item or failures of the same kind in two or more items. Major failures may include, but are not limited to, cracked or broken housings, piping, or vessels, excessive deflections, bent or broken shafts, broken or chipped gear teeth, premature bearing failure, excessive wear or excessive leakage around seals. Failures which are directly and clearly traceable to operator abuse, such as operations in conflict with published operating procedures or improper maintenance, such as substitution of unauthorized replacement parts, use of incorrect lubricants or chemicals, flagrant over- or under-lubrication and using maintenance procedures not conforming with published maintenance instructions, shall be exempted from the scope of the one-year warranty. Should multiple failures occur in a given item, all products of the same size and type shall be disassembled, inspected, modified or replaced as necessary and rewarranted for one year from the date of reassembly.
- E. The Contractor shall, at Contractor's own expense, furnish all labor, materials, tools and equipment required and shall make such repairs and removals and shall perform such work or reconstruction as may be made necessary by any structural or functional defect or failure resulting from neglect, faulty workmanship or faulty materials, in any part of the work performed by the Contractor. Such repair shall also include refilling of trenches, excavations or embankments which show settlement or erosion after backfilling or placement.
- F. Except as noted on the Drawings or as specified, all structures such as

embankments and fences shall be returned to their original condition prior to the completion of the Contract. Any and all damage to any facility not designated for removal, resulting from the Contractor's operations, shall be promptly repaired by the Contractor at no cost to the Owner.

- G. The Contractor shall be responsible for all road and entrance reconstruction and repairs and maintenance of same for the duration of the Correction Period, as defined in the General Conditions. In the event the repairs and maintenance are not made immediately and it becomes necessary for the owner of the road to make such repairs, the Contractor shall reimburse the owner of the road for the cost of such repairs.
- H. In the event the Contractor fails to proceed to remedy the defects upon notification within 15 days of the date of such notice, the Owner reserves the right to cause the required materials to be procured and the work to be done, as described in the Drawings and Specifications, and to hold the Contractor and the sureties on Contractor's bond liable for the cost and expense thereof.
- I. Notice to Contractor for repairs and reconstruction will be made in the form of a registered letter addressed to the Contractor at Contractor's home office.
- J. Neither the foregoing paragraphs nor any provision in the Contract Documents, nor any special guarantee time limit implies any limitation of the Contractor's liability within the law of the place of construction.

Part 2 Products

(NOT USED)

Part 3 Execution

(NOT USED)

END OF SECTION

Part 1 General

1.1 Work Included

- A. Demolition of designated items as noted on drawings.
- B. Unless otherwise noted, remove all demolition material from the project site and properly dispose of all demolition material at a location selected and provided by the Contractor.
- C. Final grading and finishing of site.

1.2 Project Description

- A. Demolition Plan
 - 1. General Requirements: Do not begin demolition or deconstruction until authorization is received from the Owner. Remove rubbish and debris from the project site; do not allow accumulations. Store materials that cannot be removed daily in areas specified by the Owner.

1.3 Items to Remain in Place

- A. Take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Owner. Repair or replace damaged items as approved by the Owner. Coordinate the work of this section with all other work indicated.
- B. Existing Construction Limits and Protection: Do not disturb existing construction beyond the extent indicated or necessary for installation of new construction. Provide protective measures to control accumulation and migration of dust and dirt in all work areas. Remove dust, dirt, and debris from work areas daily.
 - 1. Undisturbed areas: Protect trees, wetlands, and other existing natural features to remain within the project site which might be damaged during demolition, and which are indicated to be left in place. See drawings for tree and wetland protection fencing. Replace any tree designated to remain that is damaged during the work under this contract with like-kind or as approved by the Owner.
 - 2. Utility Service: Maintain existing utilities indicated to stay in service and protect against damage during demolition and deconstruction operations. Prior to start of work, utilities serving each area of alteration or removal will be shut off by the Owner and disconnected and sealed by the Contractor.
- C. Facilities:

1. Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities.

1.4 Availability of Work Areas

- A. Areas in which the work is to be accomplished will be available in accordance with the schedule provided by the City.

1.5 Submittals

- A. See project manual.

1.6 Quality Assurance

- A. Comply with federal, state, and local hauling and disposal regulations.
- B. Use of explosives will not be permitted.
- C. Dust and Debris Control: Prevent the spread of dust and debris and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution.

1.7 Protection

- A. Traffic Control Signs
 1. Traffic control shall be the responsibility of the Contractor.

Part 2 Products

2.1 Fill Material

- A. Comply with excavating, backfilling, and compacting procedures for soils used as backfill material to fill voids, depressions or excavations resulting from demolition of miscellaneous structures.

Part 3 Execution

3.1 Existing Facilities to Be Removed

- A. Remove items as noted on drawings.
 1. Remove concrete and asphaltic concrete paving as shown. Provide neat sawcuts at limits of pavement removal as indicated.

2. Pavement not to be used in this project shall be removed from the site at Contractor's expense.

B. Concrete

1. Saw concrete along straight lines to a depth of a minimum 2 inch. Make each cut in walls perpendicular to the face and in alignment with the cut in the opposite face. Break out the remainder of the concrete provided that the broken area is concealed in the finished work, and the remaining concrete is sound. At locations where the broken face cannot be concealed, grind smooth or saw cut entirely through the concrete.

C. Patching

1. Where removals leave holes and damaged surfaces exposed in the finished work, patch and repair these holes and damaged surfaces to match adjacent finished surfaces. Where new work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new work. Finished surfaces of patched area shall be flush with the adjacent existing surface and shall match the existing adjacent surface as closely as possible as to texture and finish.

3.2 Disposition of Material

- A. Title to Materials: Except for salvaged items specified in related Sections, and for materials or equipment scheduled for salvage, all materials and equipment removed and not reused or salvaged, shall become the property of the Contractor and shall be removed from Owner's property. Title to materials resulting from demolition, and materials and equipment to be removed, is vested in the Contractor. The Owner will not be responsible for the condition or loss of, or damage to, such property after contract award. Showing for sale or selling materials and equipment on site is prohibited.
- B. Reuse of Materials and Equipment: Remove and store materials and equipment shown on the demolition plan to be reused or relocated to prevent damage and reinstall as the work progresses.
- C. Salvaged Materials and Equipment: Remove materials and equipment that are shown on the Demolition Plan to be removed by the Contractor and that are to remain the property of the Owner, if any, and deliver to a storage site as directed by the Owner.
 1. Salvage items and material to the maximum extent possible.
 2. Store all materials salvaged for the Contractor as approved by the Owner and remove from Owner's property before completion of the contract. On site sales of salvaged material is prohibited.
 3. Remove salvaged items to remain the property of the Owner in a manner to prevent damage, and packed or crated to protect the items from damage while

in storage or during shipment. Items damaged during removal or storage must be repaired or replaced to match existing items. Properly identify the contents of containers. Deliver the following items reserved as property of the Owner to the areas designated by the Owner.

- D. **Unsalvageable and Non-Recyclable Material:** Dispose of unsalvageable and non-recyclable noncombustible material off-site in accordance with appropriate regulations.

3.3 Cleanup

- A. Remove debris and rubbish. Remove and transport the debris in a manner that prevents spillage on streets or adjacent areas. Apply local regulations regarding hauling and disposal.

3.4 Disposal of Removed Materials

- A. **Regulation of Removed Materials:** Dispose of debris, rubbish, scrap, and other non-salvageable materials resulting from removal operations in accordance with all applicable federal, state, and local regulations. Storage of removed materials on the project site is prohibited.
- B. **Removal from Owner's Property:** Transport waste materials removed from demolished and deconstructed structures, except waste soil, from Owner's property for legal disposal. Dispose of waste soil as directed by the Owner.

3.5 Reuse of Salvaged Items

- A. Recondition salvaged materials and equipment designated for reuse before installation. Replace items damaged during removal and salvage operations or restore them as necessary to usable condition.

END OF SECTION

Part 1 General

1.01 Section Includes

- A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.
- B. Openings for other work.
- C. Form accessories.
- D. Form stripping.

1.02 Reference Standards

- A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; 2010
- B. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute; 2010.
- C. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute; 2008.
- D. ACI 347 - Guide to Formwork for Concrete; American Concrete Institute; 2004.

1.03 Delivery, Storage, and Handling

- A. Deliver void forms and installation instructions in manufacturer's packaging.
- B. Store void forms off ground in ventilated and protected manner to prevent deterioration from moisture.

Part 2 Products

2.01 Formwork – General

- A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.
- B. Design and construct to provide resultant concrete that conforms to design with respect to shape, lines, and dimensions.
- C. Chamfer exposed outside corners of beams, joists, columns, and walls.
- D. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.

- E. Comply with relevant portions of ACI 347, ACI 301, and ACI 318.

2.02 Wood Form Materials

- A. Form Materials: At the discretion of the Contractor.

2.03 Prefabricated Forms

- A. Preformed Steel Forms: Minimum 16 gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- B. Pan Type: Steel, of size and profile indicated.
- C. Tubular Column Type: Round, spirally wound laminated fiber material, surface treated with release agent, non-reusable, of sizes indicated.
- D. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set; 2 inches thick.

2.04 Formwork Accessories

- A. Form Ties: Removable type, galvanized metal, fixed length, cone type, with waterproofing washer, 1/2 inch back break dimension, free of defects that could leave holes larger than 1 inch in concrete surface.
- B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.
- C. Filler Strips for Chamfered Corners: Wood strip type; 1/4x1/4 inch size; maximum possible lengths.
- D. Dovetail Anchor Slot: Galvanized steel, 22 gage thick, foam filled, release tape sealed slots, anchors for securing to concrete formwork.
- E. Flashing Reglets: Galvanized steel, 22 gage thick, longest possible lengths, with alignment splines for joints, foam filled, release tape sealed slots, anchors for securing to concrete formwork.
- F. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.
- G. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 05 1200.
- H. Waterstops: Rubber, minimum 1,750 psi tensile strength, minimum 50 degrees F to plus 175 degrees F working temperature range, 6 inch wide, maximum possible

lengths, ribbed profile, preformed corner sections, heat welded jointing.

- I. Waterstops: Preformed mineral colloid strips, 3/8 inch thick, moisture expanding.

Part 3 Execution

3.01 Examination

- A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 Earth Forms

- A. Earth forms are permitted only for un-exposed concrete.
- B. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.03 Erection – Formwork

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.
- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads
- C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- D. Align joints and make watertight. Keep form joints to a minimum.
- E. Obtain approval before framing openings in structural members that are not indicated on drawings.
- F. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.
- G. Coordinate this section with other sections of work that require attachment of components to formwork.
- H. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Engineer before proceeding.

3.04 Application – Form Release Agent

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

3.05 Inserts, Embedded Parts, and Openings

- A. Provide formed openings where required for items to be embedded in passing through concrete work.
- B. Locate and set in place items that will be cast directly into concrete.
- C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
- D. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- E. Install waterstops in accordance with manufacturer's instructions, so they are continuous without displacing reinforcement. Heat seal joints so they are watertight.
- F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.06 Form Cleaning

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
 - 1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
 - 2. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.07 Formwork Tolerances

- A. Construct formwork to maintain tolerances required by ACI 117.

3.08 Field Quality Control

- A. An independent testing agency will perform field quality control tests.
- B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

3.09 Form Removal

- A. Do not remove forms or bracing until concrete has gained sufficient to carry its own weight and imposed loads.

END OF SECTION

Part 1 General

1.01 Section Includes

- A. Reinforcing steel for cast-in-place concrete.
- B. Supports and accessories for steel reinforcement.

1.02 Reference Standards

- A. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute; 2010.
- B. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute; 2008.
- C. ACI SP-66 - ACI Detailing Manual; American Concrete Institute International; 2004.
- D. ASTM A 82/A 82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement; 2007.
- E. ASTM A 184/A 184M - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement; 2006.
- F. ASTM A 185/A 185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.
- G. ASTM A 497/A 497M - Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete; 2007.
- H. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2009b.
- I. ASTM A 704/A 704M - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement; 2006.
- J. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; American Welding Society; 2005.
- K. CRSI (DA4) - Manual of Standard Practice; Concrete Reinforcing Steel Institute; 2001.
- L. CRSI (P1) - Placing Reinforcing Bars; Concrete Reinforcing Steel Institute; Eighth Edition.

1.03 Quality Assurance

- A. Perform work of this section in accordance with ACI 301.
 - 1. Maintain one copy of each document on project site.

Part 2 Products

2.01 Reinforcement

- A. Reinforcing Steel: ASTM A 615/A 615M Grade 60 (420).
 - 1. Plain billet steel bars.
- B. Reinforcing Steel: Deformed bars, ASTM A 996/A 996M Grade 60 (420), Type A.
- C. Reinforcing Steel Mat: ASTM A 704/A 704M, using ASTM A 615/A 615M, Grade 40 (280) steel bars or rods, unfinished.
- D. Stirrup Steel: ASTM A 82/A 82M steel wire, unfinished.
- E. Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain type.
 - 1. Flat Sheets.
 - 2. Mesh Size: 6x6
 - 3. Mesh Size and Wire Gage: As indicated on drawings.
- F. Reinforcement Accessories:
 - 1. Tie Wire: Annealed, minimum 16 gage.
 - 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

2.02 Fabrication

- A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.
- B. Welding of reinforcement is permitted only with the specific approval of Engineer. Perform welding in accordance with AWS D1.4.
- C. Locate reinforcing splices not indicated on drawings at point of minimum stress.

Part 3 Execution

3.01 Placement

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
- B. Do not displace or damage vapor barrier.
- C. Accommodate placement of formed openings.
- D. Conform to applicable code for concrete cover over reinforcement.

END OF SECTION

Part 1 General

1.01 Section Includes

- A. Concrete building frame members.
- B. Elevated concrete slabs.
- C. Floors and slabs on grade.
- D. Concrete shear walls, elevator shaft walls, and foundation walls.
- E. Concrete foundations and anchor bolts for pre-engineered building.
- F. Concrete reinforcement.
- G. Joint devices associated with concrete work.
- H. Miscellaneous concrete elements, including equipment pads, light pole bases, flagpole bases, thrust blocks, and manholes.
- I. Concrete curing.

1.02 Reference Standards

- A. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute; 2010.
- B. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute; 2008.
- C. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2010.
- D. ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International; 2004 (Errata 2007).
- E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.
- F. ACI 305R - Hot Weather Concreting; American Concrete Institute International; 2010.
- G. ACI 306R - Cold Weather Concreting; American Concrete Institute International; 2010.
- H. ACI 308R - Guide to Curing Concrete; American Concrete Institute International; 2001 (Reapproved 2008).

Cast-in-Place Concrete

- I. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2008.
- J. ACI 347 - Guide to Formwork for Concrete; American Concrete Institute International; 2004.
- K. ASTM A 185/A 185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.
- L. ASTM A 497/A 497M - Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete; 2007.
- M. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2009b.
- N. ASTM C 33 - Standard Specification for Concrete Aggregates; 2008.
- O. ASTM C 39/C 39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2009a.
- P. C 94/C 94M - Standard Specification for Ready-Mixed Concrete; 2009a.
- Q. ASTM C 150 - Standard Specification for Portland Cement; 2007.
- R. ASTM C 173/C 173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2009.
- S. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete; 2006.
- T. ASTM C 494/C 494M - Standard Specification for Chemical Admixtures for Concrete; 2008a.
- U. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2008a.
- V. ASTM C 881/C 881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2002.
- W. ASTM C 1107/C 1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2008.
- X. ASTM C 1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures; 2005.
- Y. ASTM E 1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2009.

1.03 Quality Assurance

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
- B. Follow recommendations of ACI 305R when concreting during hot weather.
- C. Follow recommendations of ACI 306R when concreting during cold weather.

Part 2 Products

2.01 Formwork

- A. Formwork Design and Construction: Comply with guidelines of ACI 347 to provide formwork that will produce concrete complying with tolerances of ACI 117.
- B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
 - 1. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
 - 2. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches of concrete surface.

2.02 Reinforcement

- A. Reinforcing Steel: ASTM A 615/A 615M Grade 60 (420).
 - 1. Type: Deformed billet-steel bars.
 - 2. Finish: Unfinished, unless otherwise indicated.
- B. Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain type.
 - 1. Mesh Size and Wire Gage: As indicated on drawings.

2.03 Concrete Materials

- A. Cement: ASTM C 150, Type I – Normal Portland type.
 - 1. Acquire all cement for entire project from same source.
- B. Fine and Course Aggregates: ASTM C 33.
 - 1. Acquire all aggregates for entire project from same source.
- C. Fly Ash: ASTM C 618, Class C or F.
- D. Calcined Pozzolan: ASTM C 618, Class N.
- E. Silica Fume: ASTM C 1240, proportioned in accordance with ACI 211.1.

- F. Water: Clean and not detrimental to concrete.

2.04 Chemical Admixtures

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
- B. Air Entrainment Admixture: ASTM C 260.
- C. High Range Water Reducing and Retarding Admixture: ASTM C 494/C 494M Type G.
- D. High Range Water Reducing Admixture: ASTM C 494/C 494M Type F.
- E. Water Reducing and Accelerating Admixture: ASTM C 494/C 494M Type E.
- F. Water Reducing and Retarding Admixture: ASTM C 494/C 494M Type D.
- G. Accelerating Admixture: ASTM C 494/C 494M Type C.

2.05 Accessory Materials

- A. Non-Shrink Cementitious Grout: ASTM C 1107/C 1107M; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
- B. Non-Shrink Epoxy Grout: Moisture-insensitive, two-part; consisting of epoxy resin, non-metallic aggregate, and activator.

2.06 Bonding and Jointing Products

- A. Epoxy Bonding System: Complying with ASTM C 881/C 881M and of Type required for specific application.
- B. Waterstops: PVC, complying with COE CRD-C 572.
- C. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.
- D. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with minimum 1 inch diameter holes for conduit or rebar to pass through at 6 inches on center; ribbed steel stakes for setting.

2.07 Concrete Mix Design

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

- B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
 - 1. For trial mixtures method, employ independent testing agency acceptable to Engineer for preparing and reporting proposed mix designs.
- C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.
- D. Normal Weight Concrete:
 - 1. Compressive Strength, when tested in accordance with ASTM C 39/C 39M at 28 days: As indicated on drawings.
 - 2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
 - 3. Calcined Pozzolan Content: Maximum 10 percent of cementitious materials by weight.
 - 4. Silica Fume Content: Maximum 5 percent of cementitious materials by weight.
 - 5. Cement Content: Minimum per cubic yard to attain specified Minimum 28 day compressive strength.
 - 6. Water-Cement Ratio: Maximum 40 percent by weight.
 - 7. Total Air Content: 4 percent, determined in accordance with ASTM C 173/C 173M.
 - 8. Maximum Slump: 3 inches
 - 9. Maximum Aggregate Size: 5/8 inch

2.08 Mixing

- A. Transit Mixers: Comply with ASTM C 94/C 94M

Part 3 Execution

3.01 Examination

3.02 Preparation

- A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.

- B. Verify that forms are clean and free of rust before applying release agent.
- C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
 - 1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.

3.03 Installing Reinforcement and Other Embedded Items

- A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.
- B. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.
- C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

3.04 Placing Concrete

- A. Place concrete in accordance with ACI 304R.
- B. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

3.05 Slab Jointing

- A. Locate joints as indicated on drawings.
- B. Anchor joint fillers and devices to prevent movement during concrete placement.
- C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
- D. Load Transfer Construction and Contraction Joints: Install load transfer devices as indicated; saw cut joint at surface as indicated for contraction joints.
- E. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.

3.06 Concrete Finishing

- A. Repair surface defects, including tie holes, immediately after removing formwork.
- B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.
- C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:

3.07 Curing and Protection

- A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.08 Field Quality Control

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- D. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

3.09 Defective Concrete

- A. Test Results: The testing agency shall report test results in writing to Engineer and Contractor within 24 hours of test.
- B. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- C. Repair or replacement of defective concrete will be determined by the Engineer. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

END OF SECTION

Part 1 General

1.01 Section Includes

- A. Mortar for Masonry.
- B. Grout for Masonry.

1.02 Reference Standards

- A. ACI 530/530.1/ERTA – Building Code Requirements and Specifications for Masonry Structures, American Institute International; 2009.
- B. ASTM C 91 - Standard Specification for Masonry Cement; 2005.
- C. ASTM C 94/C 94M - Standard Specification for Ready-Mixed Concrete; 2009a.
- D. ASTM C 150 - Standard Specification for Portland Cement; 2007.
- E. ASTM C 270 - Standard Specification for Mortar for Unit Masonry; 2008a.
- F. ASTM C 404 - Standard Specification for Aggregates for Masonry Grout; 2007.
- G. ASTM C 780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2009.
- H. ASTM C 1019 - Standard Test Method for Sampling and Testing Grout; 2009.
- I. ASTM C 1072 - Standard Test Method for Measurement of Masonry Flexural Bond Strength; 2006.
- J. ASTM C 1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2009.

1.03 Quality Assurance

- A. Comply with provisions of ACI 530/ASCE 5/TMS 402, except where exceeded by requirements of the contract documents.
 - 1. Maintain one copy of each document on project site.

1.04 Delivery, Storage, and Handling

- A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.05 Field Conditions

- A. Cold and Hot Weather Requirements: Comply with requirements of ACI

530/530.1/ERTA or applicable building code, whichever is more stringent.

Part 2 Products

2.01 Materials

- A. Masonry Cement: ASTM C 91, Type N.
- B. Portland Cement: ASTM C 150, Type I – Normal; color as required to produce approved color sample.

2.02 Mortar Mixes

- A. Masonry Cement: ASTM C 91, Type N.
- B. Portland Cement: ASTM C 150, Type I - Normal; color as required to produce approved color sample.
- C. Water: Clean and potable.
- D. Bonding Agent: Latex type

2.03 Mortar Mixing

- A. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C 270 and in quantities needed for immediate use.
- B. Maintain sand uniformly damp immediately before the mixing process.
- C. Do not use anti-freeze compounds to lower the freezing point of mortar.
- D. If water is lost by evaporation, re-temper only within two hours of mixing.

2.04 Grout Mixes

- A. Bond Beams and Lintels: 3,000 psi strength at 28 days; 8-10 inches slump; provide premixed type in accordance with ASTM C 94/C 94M.
 - 1. Fine grout for spaces with smallest horizontal dimension of 2 inches or less.
 - 2. Coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

2.05 Grout Mixing

- A. Mix grout in accordance with ASTM C 94/C 94M.

Part 3 Execution

3.01 Preparation

- A. Apply bonding agent to existing concrete surfaces.
- B. Plug clean-out holes for grouted masonry with brick masonry units. Brace masonry to resist wet grout pressure.

3.02 Installation

- A. Install mortar and grout to requirements of section(s) in which masonry is specified.
- B. Work grout into masonry cores and cavities to eliminate voids.
- C. Do not install grout in lifts greater than 16 inches without consolidating grout by rodding.
- D. Do not displace reinforcement while placing grout.
- E. Remove excess mortar from grout spaces.

3.03 Grouting

- A. Use either high-lift or low-lift grouting techniques, at Contractor's option, subject to other limitations of contract documents.
- B. Low-Lift Grouting:
 - 1. Limit height of pours to 24 inches.
 - 2. Limit height of masonry to 24 inches above each pour.
 - 3. Pour grout only after vertical reinforcing is in place; place horizontal reinforcing as grout is poured. Prevent displacement of bars as grout is poured.
 - 4. Place grout for each pour continuously and consolidate immediately; do not interrupt pours for more than 1-1/2 hours.
- C. High-Lift Grouting:
 - 1. Verify that horizontal and vertical reinforcement is in proper position and adequately secured before beginning pours.
 - 2. Brick: Limit pours to maximum 12 feet in height and 25 feet horizontally.
 - 3. Hollow Masonry: Limit lifts to maximum 8 feet and pours to maximum height of 24 feet

4. Place grout for spanning elements in single, continuous pour.

3.04 Field Quality Control

- A. Test and evaluate mortar in accordance with ASTM C 780 procedures.
 1. Test with same frequency as specified masonry units.

END OF SECTION

Part 1 General

1.01 Section Includes

- A. Concrete Block.
- B. Mortar and Grout.
- C. Reinforcement and Anchorage.
- D. Lintels.
- E. Accessories.

1.02 Reference Standards

- A. ACI 530/530.1/ERTA – Building Code Requirements and Specifications for Masonry Structures, American Institute International; 2009.
- B. ASTM A 36/A 36M – Standard Specification for Carbon Structural Steel; 2008.
- C. ASTM A 82/A 82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement; 2007.
- D. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- E. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2009b.
- F. ASTM A 641/A 641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a.
- G. ASTM C 90 - Standard Specification for Loadbearing Concrete Masonry Units; 2009.
- H. ASTM C 91 - Standard Specification for Masonry Cement; 2005.
- I. ASTM C 129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2006.
- J. ASTM C 140 - Standard Test Methods of Sampling and Testing Concrete Masonry Units and Related Units; 2010.
- K. ASTM C 144 - Standard Specification for Aggregate for Masonry Mortar; 2004.
- L. ASTM C 150 - Standard Specification for Portland Cement; 2007.

Masonry

- M. ASTM C 207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006.
- N. ASTM C 270 - Standard Specification for Mortar for Unit Masonry; 2008a.
- O. ASTM C 404 - Standard Specification for Aggregates for Masonry Grout; 2007.
- P. ASTM C 476 - Standard Specification for Grout for Masonry; 2009.
- Q. ASTM C 780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2009.
- R. ASTM C 1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2009.

1.03 Administrative Requirements

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.04 Submittals

- A. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
- B. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.
- C. Test Reports: Concrete masonry manufacturer's test reports for units with integral water repellent admixture.

1.05 Quality Assurance

- A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.

1.06 Delivery, Storage, and Handling

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

Part 2 Products

2.01 Concrete Masonry Units

- A. Concrete Block: Comply with referenced standards and as follows:
 - 1. Size: Standard units with nominal face dimensions of 16 x 8 inches and nominal depth of 8 inches.

2. Special Shapes: Provide non-standard blocks configured for corners.
3. Load-Bearing Units: ASTM C 90, normal weight.
 - a. Hollow block, as indicated.
4. Non-Load Bearing Units: ASTM C 129.
 - a. Hollow block, as indicated.

2.02 Mortar and Grout Materials

- A. Masonry Cement: ASTM C 91, Type N.
 1. Colored mortar: Premixed cement as required to match Engineer's color sample.
- B. Portland Cement: ASTM C 150, Type I; color as required to produce approved color sample.
- C. Hydrated Lime: ASTM C 207, Type S.
- D. Mortar Aggregate: ASTM C 144.
- E. Grout Aggregate: ASTM C 404.
- F. Water: Clean and potable.
- G. Accelerating Admixture: Nonchloride type for use in cold weather.

2.03 Reinforcement and Anchorage

- A. Reinforcing Steel: Type specified on drawings; size as indicated on drawings; uncoated finish.
- B. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
- C. Single Wythe Joint Reinforcement: Truss type; ASTM A 82/A 82M steel wire, mill galvanized to ASTM A 641/A 641M, Class 3; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.
- D. Multiple Wythe Joint Reinforcement: Truss type; fabricated with moisture drip; ASTM A 82/A 82M steel wire, hot dip galvanized after fabrication to ASTM A 153/153M, Class B; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.

- E. Strap Anchors: Bent steel shapes configured as required for specific situations, 1-1/4 in width, 0.105 in thick, lengths as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face, corrugated for embedment in masonry joint, hot dip galvanized to ASTM A 153/A 153M, Class B.
- F. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face.
 - 1. Concrete frame: Dovetail anchors of bent steel strap, nominal 1 inch width x 0.024 in thick, with trapezoidal wire ties 0.1875 inch thick, hot dip galvanized to ASTM A 153/A 153M, Class B.
 - 2. Steel frame: Crimped wire anchors for welding to frame, 0.25 inch thick, with trapezoidal wire ties 0.1875 inch thick, hot dip galvanized to ASTM A 153/A 153M, Class B.
- G. Wall Ties: Corrugated formed sheet metal, 7/8 inch wide by 0.05 inch thick, hot dip galvanized to ASTM A 153/A 153M, Class B, sized to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face.
- H. Two-Piece Wall Ties: Formed steel wire, 0.1875 inch thick, adjustable, eye and pintle type, hot dip galvanized to ASTM A 153/A 153M, Class B, sized to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face and to allow vertical adjustment of up to 1-1/4 in.
- I. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
 - 1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
 - 2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
 - 3. Vertical adjustment: Not less than 3-1/2 inches.

2.04 Accessories

- A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
- B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; 3/4 inch wide x by maximum lengths available.
- C. Weeps: Polyethylene tubing.

- D. Cavity Vents: Polyester mesh.
- E. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.05 Mortar and Grout Mixes

- A. Mortar for Unit Masonry: ASTM C 270, using the Proportion Specification.
 - 1. Masonry below grade and in contact with earth: Type S.
 - 2. Exterior, load bearing masonry: Type N.
 - 3. Exterior, non-load bearing masonry: Type N.
 - 4. Interior, load bearing masonry: Type N.
 - 5. Interior, non-load bearing masonry: Type N.
- B. Grout: ASTM C 476. Consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

Part 3 Execution

3.01 Examination

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 Preparation

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 Cold and Hot Weather Requirements

- A. Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

3.04 Coursing

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
 - 1. Bond: Running.
 - 2. Coursing: One unit and one mortar joint to equal 8 inches.
 - 3. Mortar Joints: Concave.

3.05 Placing and Bonding

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- D. Remove excess mortar and mortar smears as work progresses.
- E. Interlock intersections and external corners.
- F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- H. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.06 Weeps/Cavity Vents

- A. Install weeps in veneer and cavity walls at 32 inches on center horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls.
- B. Install cavity vents in veneer and cavity walls at 32 inches on center horizontally below shelf angles and lintels, and near top of walls.

3.07 Cavity Mortar Control

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

- B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.

3.08 Reinforcement and Anchorage – General

- A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Place continuous joint reinforcement in first and second joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches.
- E. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches on center.
- F. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches horizontally and 24 inches vertically.

3.09 Reinforcement and Anchorages – Cavity Wall Masonry

- A. Install horizontal joint reinforcement 16 inches on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 32 inches each side of openings.
- C. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Space anchors at maximum of 24 inches horizontally and 16 inches vertically.
- D. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches on center.

3.10 Masonry Flashings

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

3.11 Lintels

- A. Install precast concrete lintels over openings.
- B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.
 - 1. Do not splice reinforcing bars.

2. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
3. Place and consolidate grout fill without displacing reinforcing.
4. Allow masonry lintels to attain specified strength before removing temporary supports.

3.12 Grouted Components

- A. Lap splices minimum 48 bar diameters.
- B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- C. Place and consolidate grout fill without displacing reinforcing.
- D. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.

3.13 Control and Expansion Joints

- A. Do not continue horizontal joint reinforcement through control and expansion joints.
- B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

3.14 Built-In Work

- A. As work progresses, install built-in metal door frames and other items to be built into the work and furnished under other sections.
- B. Install built-in items plumb, level, and true to line.
- C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
- D. Do not build into masonry construction organic materials that are subject to deterioration.

3.15 Tolerances

- A. Maximum Variation from Alignment of Columns: 1/4 inch.
- B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

- D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
- F. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.
- G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.16 Cutting and Fitting

- A. Cut and fit for chases. Coordinate with other sections of work to provide correct size, shape, and location.
- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.17 Field Quality Control

- A. An independent testing agency will perform field quality control tests.
- B. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C 140 for conformance to requirements of this specification.
- C. Mortar Tests: Test each type of mortar in accordance with ASTM C 780, testing with same frequency as masonry samples.

3.18 Cleaning

- A. Remove excess mortar and mortar droppings.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.

3.19 Protection

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities

END OF SECTION

Part 1 General

1.01 Section Includes

- A. Structural steel framing members, support members, sag rods, and struts.
- B. Base plates, shear stud connectors and expansion joint plates.
- C. Grouting under base plates.

1.02 Reference Standards

- A. AISC (MAN) - Steel Construction Manual; American Institute of Steel Construction, Inc.; 2005.
- B. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges; American Institute of Steel Construction, Inc.; 2005.
- C. AISC S348 - Specification for Structural Joints Using ASTM A325 or A490 Bolts; 2004.
- D. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel; 2008.
- E. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2007.
- F. ASTM A 108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished; 2007.
- G. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2009.
- H. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- I. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength; 2007b.
- J. ASTM A 325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2009a.
- K. ASTM A 490 - Standard Specification for Structural Bolts, Alloy Steel, Heat-Treated, 150 ksi Minimum Tensile Strength; 2009.
- L. ASTM A 500/A 500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2010.
- M. ASTM A 501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2007.

- N. ASTM A 572/A 572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel; 2007.
- O. ASTM A 992/A 992M - Standard Specification for Structural Steel Shapes; 2006a.
- P. ASTM C 1107/C 1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2008.
- Q. ASTM F 1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2007a.
- R. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society; 2007.
- S. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010.

Part 2 Products

2.01 Materials

- A. Steel Angles and Plates: ASTM A 36/A 36M.
- B. Steel W Shapes and Tees: ASTM A 992/A 992M.
- C. Rolled Steel Structural Shapes: ASTM A 992/A 992M.
- D. Steel Plates and Bars: ASTM A 572/A 572M, Grade 50 (345) high-strength, columbium-vanadium steel.
- E. Cold-Formed Structural Tubing: ASTM A 500, Grade B.
- F. Shear Stud Connectors: Made from ASTM A 108 Grade 1015 bars.
- G. Sag Rods: ASTM A 36/A 36M.
- H. Structural Bolts and Nuts: Carbon steel, ASTM A 307, Grade A galvanized to ASTM A 153/A 153M, Class C.
- I. Grout: Non-shrink, non-metallic aggregate type, complying with ASTM C 1107/C 1107M and capable of developing a minimum compressive strength of 7,000 psi at 28 days.

2.02 Fabrication

- A. Shop fabricate to greatest extent possible.

- B. Continuously seal joined members by continuous welds. Grind exposed welds smooth.
- C. Fabricate connections for bolt, nut, and washer connectors.

2.03 Finish

- A. Galvanize structural steel members to comply with ASTM A 123/A 123M. Provide minimum 1.7 oz/sq ft galvanized coating.

2.04 Source Quality Control

- A. Provide shop testing and analysis of structural steel.
- B. High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts", testing at least 2 of bolts at each connection.

Part 3 Execution

3.01 Examination

- A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.02 Erection

- A. Erect structural steel in compliance with AISC "Code of Standard Practice for Steel Buildings and Bridges".
- B. Field weld components and shear studs indicated on shop drawings.
- C. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts".
- D. Do not field cut or alter structural members without approval of Engineer.
- E. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for non-shrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.03 Tolerances

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION

Part 1 General

1.01 Section Includes

- A. Shop fabricated steel items.

1.02 Reference Standards

- A. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008.
- B. ASTM A 36 - Standard Specification for Carbon Structural Steel; 2008.
- C. ASTM A 53- Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2007.
- D. ASTM A 123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2009.
- E. ASTM A 153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- F. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength; 2007b.
- G. ASTM A 325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2009a.
- H. ASTM A 500- Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2010.
- I. ASTM A 501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2007.
- J. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society; 2007.
- K. AWS D1.1- Structural Welding Code - Steel; American Welding Society; 2010.
- L. SSPC-Paint 15 - Steel Joist Shop Primer; Society for Protective Coatings; 1999 (Ed. 2004).
- M. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).
- N. SSPC-SP 2 - Hand Tool Cleaning; Society for Protective Coatings; 1982 (Ed. 2004).

Part 2 Products

2.01 Materials - Steel

- A. Steel Sections: ASTM A992.
- B. Steel Tubing: ASTM A 500, Grade C cold-formed structural tubing.
- C. Plates/Angles: ASTM A36.
- D. Pipe: ASTM A 53, Grade B Schedule 40, black finish.
- E. Bolts, Nuts, and Washers: ASTM A 325, Type 1, galvanized to ASTM A 153 where connecting galvanized components.
- F. Welding Materials: AWS D1.1; type required for materials being welded.
- G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- H. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 Fabrication

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Continuously seal joined members by continuous welds.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 Fabricated Items

- A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; galvanized finish.
 - 1. Side Rails: 3/8 x 2 inches members spaced at 20 inches
 - 2. Rungs: one inch diameter solid round bar spaced 12 inches on center.
- B. Bumper Posts and Guard Rails: As detailed; Paint all with "Safety Yellow" epoxy paint finish.

- C. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; Paint all with "Safety Yellow" epoxy paint finish.
- D. Lintels: As detailed; prime paint finish.

2.04 Finishes - Steel

- A. Prime paint all steel items.
 - 1. Exceptions: Galvanize all items as called for on the drawings.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A 123 requirements.
- E. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A 123 requirements.

2.05 Fabrication Tolerances

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

Part 3 Execution

3.01 Examination

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 Preparation

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 Installation

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Obtain approval prior to site cutting or making adjustments not scheduled.

END OF SECTION

Part 1 General

1.01 Section Includes

- A. Rou.
- B. Bridging, bracing, and anchorage.

1.02 Reference Standards

- A. ALSC (American Lumber Standards Committee) - Softwood Lumber Standards.
- B. APA (American Plywood Association).
- C. ASTM A446 - Sheet Steel, Zinc Coated (Galvanized) by the Hot Dip Process, (Structural Physical) Quality.
- D. IBC (International Building Code)
- E. SPIB (Southern Pine Inspection Bureau).
- G. (2015) Timber Construction Manual

1.03 Submittals

- A. No submittals required.

1.05 Quality Assurance

- A. Perform Work in accordance with the following agencies:
 - 1. Lumber Grading Agency: Certified by ALSC.
 - 2. Plywood Grading Agency: Certified by APA.

1.06 Regulatory Requirements

- A. Conform to IBC latest edition for loads, seismic zoning, other governing load criteria.

1.07 Delivery, Storage, and Protection

- A. Deliver materials to the site in an undamaged condition.

Rough Carpentry

- B. Store, protect, handle, and install prefabricated structural elements in accordance with manufacturer's instructions and as specified.
- C. Store materials off the ground to provide proper ventilation, with drainage to avoid standing water, and protection against ground moisture and dampness.
- D. Store materials with a moisture barrier at both the ground level and as a cover forming a well ventilated enclosure.
- E. Do not use materials that have visible moisture or biological growth. Remove defective and damaged materials and provide new materials.
- F. Store separated reusable wood waste convenient to cutting station and area of work.

Part 2 Products

2.01 Manufacturers

- A. Product options and substitutions permitted.

2.02 Materials

- A. Lumber Grading Rules: SPIB.
- B. Stud/Joist Members: Southern Pine species No. 2 grade, 15 percent maximum and 7 percent minimum moisture content.

2.03 Lumber

- A. Structural Lumber
 - 1. All lumber framing shall be as indicated on construction documents.
- B. Fasteners and Anchors:
 - 1. Fasteners: Hot dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
 - 2. Anchors: Bolt or ballistic fastener for anchorages to steel.

2.04 Plywood

- A. Wall Sheathing
 - 1. As indicated on construction documents.

- B. Roof Sheathing
 - 1. As indicated on construction documents.

2.04 Rough Hardware

- A. Bolts, Nuts, Studs, and Rivets: ASME B18.2.1, ASME B18.5.2.1M, ASME B18.5.2.2M and ASME B18.2.2.
- B. Anchor Bolts: ASTM A307, size as indicated, complete with nuts and washers.
- C. Lag Screws and Lag Bolts: ASME B18.2.1.
- D. Wood Screws: ASME B18.6.1.
- E. Nails
 - 1. ASTM F547, size and type best suited for purpose.
 - 2. For sheathing and subflooring, length of nails must be sufficient to extend 1 inch into supports. In general, 8-penny or larger nails must be used for nailing through 1 inch thick lumber and for toe nailing 2 inch thick lumber; 16-penny or larger nails must be used for nailing through 2 inch thick lumber.
 - 3. Nails used with treated lumber and sheathing must be hot-dipped galvanized in accordance with ASTM A153/A153M.
 - 4. Nailing must be in accordance with the recommended nailing schedule contained in AWC WFCM.
 - 5. Where detailed nailing requirements are not specified, nail size and spacing must be sufficient to develop an adequate strength for the connection. The connection's strength must be verified against the nail capacity tables in AWC NDS.
 - 6. Reasonable judgment backed by experience must ensure that the designed connection will not cause the wood to split. If a load situation exceeds a reasonable limit for nails, a specialized connector must be used.
- F. Joist Hangers: Steel or iron, zinc coated, sized to fit the supported member, of sufficient strength to develop the full strength of the supported member in accordance with ICC IBC, and furnished complete with any special nails required.
- G. Panel Edge Clips: Extruded aluminum or galvanized steel, H-shaped clips to prevent differential deflection of roof sheathing.

Part 3 Execution

3.02 Preparation

- A. Coordinate placement of bearing support items.

3.03 Erection

- A. Set members level and plumb, in correct position.
- B. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure plumb, and in true alignment until completion of erection and installation of permanent bracing.
- D. Do not field cut or alter structural members without approval of Architect/Engineer.
- F. Place headers and supports to frame openings.
- G. Coordinate placement of sheathing with work of this section.
- H. Anchor lumber framing with hurricane ties where indicated on construction documents.

END OF SECTION

Part 1 General

1.01 Section Includes

- A. Shop fabricated wood trusses for roof framing.
- B. Bridging, bracing, and anchorage.

1.02 Reference Standards

- A. ALSC (American Lumber Standards Committee) - Softwood Lumber Standards.
- B. APA (American Plywood Association).
- C. ASTM A446 - Sheet Steel, Zinc Coated (Galvanized) by the Hot Dip Process, (Structural Physical) Quality.
- D. IBC (International Building Code)
- E. SPIB (Southern Pine Inspection Bureau).
- F. TPI (Truss Plate Institute) BWT-76 - Bracing Wood Trusses.
- G. TPI (Truss Plate Institute) HET-80 - Handling and Erecting Wood Trusses.
- H. TPI (Truss Plate Institute) PCT-85 - Metal Plate Connected Wood Trusses.
- I. TPI (Truss Plate Institute) QSP-88 - Metal Plate Connected Wood Trusses.

1.03 Submittals

- A. Product Data: Provide truss configurations, bearing and anchor details, bridging and bracing.
- B. Shop Drawings: Indicate sizes and spacing of trusses and associated components, web and chord sizes, plate sizes, fastener descriptions and spacings, loads and truss cambers, and framed openings. Submit design calculations signed and sealed by a Professional Structural Engineer licensed at the place where the project is located.

1.04 System Description

- A. Design Roof Loads: Top cord live load 20 lbs./sq.ft. and dead load 15 sq. ft. bottom cord dead load 15 lb/sq. ft. and base wind speed per IBC latest edition.

1.05 Quality Assurance

- A. Perform Work in accordance with the following agencies:
 - 1. Lumber Grading Agency: Certified by ALSC.
 - 2. Plywood Grading Agency: Certified by APA.
- B. Truss Design, Fabrication, and Installation: In accordance with Truss Plate Institute BWT-76, HET-80, PCT-80 including Supplement, TPI-85 including Supplement, QSP-88.
- C. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.
- D. Design trusses under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at the place where the Project is located.

1.06 Regulatory Requirements

- A. Conform to IBC latest edition for loads, seismic zoning, other governing load criteria.

1.07 Delivery, Storage, and Protection

- A. Handle and erect trusses in accordance with TPI HET-80.
- B. Store truss depth in vertical position resting on intermittent bearing pads.

Part 2 Products

2.01 Manufacturers

- A. Landford Truss
- B. Phillips Frame and Truss, Inc.
- C. Product options and substitutions permitted.

2.02 Materials

- A. Lumber Grading Rules: SPIB.
- B. Wood Members: Single top and bottom chord, Southern Pine species No. 1 dense grade, 15 percent maximum and 7 percent minimum moisture content.
- C. Steel Plate Connectors: ASTM A446 steel, Grade B, hot dip galvanized; die stamped with integral teeth; 0.040 inch thick.

- D. Truss Bridging: Type, size and spacing recommended by truss manufacturer.

2.03 Accessories

- A. Wood Blocking Framing for Openings: In accordance with Section 06 10 00.
- B. Fasteners and Anchors:
 - 1. Fasteners: Hot dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
 - 2. Anchors: Bolt or ballistic fastener for anchorages to steel.

2.04 Fabrication

- A. Fabricate trusses to achieve structural requirements specified.
- B. Brace wood trusses for support in accordance with TPI BWT-76.
- C. Provide bottom and top chord extensions as indicated.

Part 3 Execution

3.01 Examination

- A. Verify that supports and openings are ready to receive trusses.

3.02 Preparation

- A. Coordinate placement of bearing support items.

3.03 Erection

- A. Install trusses in accordance with manufacturer's instructions and TPI BWT-76.
- B. Set members level and plumb, in correct position.
- C. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure plumb, and in true alignment until completion of erection and installation of permanent bracing.
- D. Do not field cut or alter structural members without approval of Architect/Engineer.
- E. Frame openings between trusses with lumber in accordance with Section 06 10 00.
- F. Place headers and supports to frame openings.

Shop Fabricated Wood Trusses

- G. Coordinate placement of sheathing with work of this section.
- H. Anchor trusses to wall with hurricane ties.

END OF SECTION

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 standing-seam metal roof panels.

1.3 Preinstallation Meetings

- A. Preinstallation Conference: Conduct conference at Project site.
 1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 5. Review structural loading limitations of deck, purlins and rafters during and after roofing.
 6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
 7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 8. Review temporary protection requirements for metal panel systems during and after installation.
 9. Review procedures for repair of metal panels damaged after installation.
 10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

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 each type of panel and accessory.
- B. Shop Drawings:
 - 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
 - 2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches (1:10).
- C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.
 - 1. Include similar Samples of trim and accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Metal Panels: 12 inches (305 mm) long by actual panel width. Include clips, fasteners, closures, and other metal panel accessories.

1.5 Informational Submittals

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Field quality-control reports.
- D. Sample Warranties: For special warranties.

1.6 Closeout Submittals

- A. Maintenance Data: For metal panels to include in maintenance manuals.

1.7 Quality Assurance

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the

same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

- C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical roof area and eave, including fascia, and soffit as shown on Drawings; approximately 48 inches (1200 mm), 12 feet (3.5 m) square by full thickness, including attachments, underlayment, and accessories.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 Delivery, Storage, And Handling

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.

1.9 Field Conditions

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.10 Coordination

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
- B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 Warranty

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.
- C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
 - 1. Warranty Period: 20 years from date of Substantial Completion.

Part 2 Products

2.1 Performance Requirements

- A. Energy Performance: Provide roof panels that are listed on the EPA/DOE's ENERGY STAR "Roof Product List" for low-slope roof products.
- B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
 - 1. Wind Loads: As indicated on Drawings.

2. Other Design Loads: As indicated on Drawings.
 3. Deflection Limits: For wind loads, no greater than 1/180 of the span.
- C. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
1. Uplift Rating: UL 60.
- D. FM Global Listing: Provide metal roof panels and component materials that comply with requirements in FM Global 4471 as part of a panel roofing system and that are listed in FM Global's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.
1. Fire/Windstorm Classification: Class 1A-90.
 2. Hail Resistance: MH.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 Standing-Seam Metal Roof Panels

- A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
1. Aluminum Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1637.
- B. Vertical-Rib, Snap-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and snapping panels together.
1. Advanced Architectural Products
 2. Advanced Building Products Inc.
 3. AEP Span; A BlueScope Steel Company

4. Architectural Building Components
 5. Architectural Metal Systems
 6. ATAS International, Inc.
 7. Berridge Manufacturing Company
 8. CENTRIA Architectural Systems
 9. Dimensional Metals, Inc.
 10. Drexel Metals
 11. Englert, Inc.
 12. Fabral
 13. Firestone Building Products
 14. Firestone Metal Products, LLC
 15. Flexospan Steel Buildings, Inc.
 16. Garland Company, Inc. (The)
 17. IMETCO
 18. MBCI; a division of NCI Group, Inc.
 19. McElroy Metal, Inc.
 20. Merchant & Evans Inc.
 21. Metal Sales Manufacturing Corporation
 22. Morin – A Kingspan Group Company
 23. Petersen Aluminum Corporation
 24. Ryerson Tull, Inc.
 25. Ultra Seam Incorporated
 26. Union Corrugating Company
 27. VICWEST
- C. Aluminum Sheet: Coil-coated sheet, ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

1. Thickness: 0.040 inch (1.02 mm).
2. Surface: Smooth, flat finish.
3. Exterior Finish: Three-coat fluoropolymer.
4. Color: Silver Metallic

2.3 Underlayment Materials

- A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils (0.76 mm) thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.
1. Thermal Stability: Stable after testing at 240 deg F (116 deg C); ASTM D 1970.
 2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.
 3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Carlisle Residential
 - b. Drexel Metals
 - c. GCP Applied Technologies, Inc.
 - d. Henry Company
 - e. Kirsch Building Products, LLC.
 - f. Owens Corning
- B. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

2.4 Miscellaneous Materials

- A. Miscellaneous Metal Subframing and Furring: ASTM C 645; cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings,

sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Gutters: Formed from same material as roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- (2400-mm-) long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches (914 mm) o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match metal roof panels & roof fascia and rake trim.
- E. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot- (3-m-) long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Finish downspouts to match gutters.
- F. Panel Fasteners: Self-tapping screws designed to withstand design loads.
- G. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
 2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.5 Fabrication

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

2.6 Finishes

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Aluminum Panels and Accessories:
 - 1. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

Part 3 Execution

3.1 Examination

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 - 1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
 - 2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Preparation

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 Underlayment Installation

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated on Drawings, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (152 mm) staggered 24 inches (610 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Extend underlayment into gutter trough. Roll laps with roller. Cover underlayment within 14 days.

1. Apply over the entire roof surface.

- B. Slip Sheet: Apply slip sheet over underlayment before installing metal roof panels.

3.4 Metal Panel Installation

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.

2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.

3. Install screw fasteners in predrilled holes.

4. Locate and space fastenings in uniform vertical and horizontal alignment.

5. Install flashing and trim as metal panel work proceeds.

6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.

7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.

8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

- B. Fasteners:

1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
- C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.
- D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
 1. Install clips to supports with self-tapping fasteners.
 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
 4. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
 5. Watertight Installation:
 - a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.
 - b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
 - c. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.
- F. Clipless Metal Panel Installation: Fasten metal panels to supports with screw fasteners at each lapped joint at location and spacing recommended by manufacturer.
- G. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.
- H. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed 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 weather resistant.
1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).
- I. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches (914 mm) o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- J. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1524 mm) o.c. in between.
1. Provide elbows at base of downspouts to direct water away from building.
- K. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.5 Erection Tolerances

- A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.6 Field Quality Control

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.
- B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.
- C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

3.7 Cleaning and Protection

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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 fiber-cement soffit.

1.3 Coordination

- A. Coordinate siding installation with flashings and other adjoining construction to ensure proper sequencing.

1.4 Preinstallation Meetings

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 Action Submittals

- A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Samples for Initial Selection: For fiber-cement soffit including related accessories.
- C. Samples for Verification:
 - 1. 12-inch- (300-mm-) long-by-actual-width Sample of soffit.
 - 2. 12-inch- (300-mm-) long-by-actual-width Samples of trim and accessories.

1.6 Informational Submittals

- A. Product Certificates: For each type of fiber-cement soffit.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement siding.
- C. Research/Evaluation Reports: For each type of fiber-cement siding required, from ICC-ES.
- D. Sample Warranty: For special warranty.

1.7 Closeout Submittals

- A. Maintenance Data: For each type of product, including related accessories, to include in maintenance manuals.

1.8 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. Furnish full lengths of fiber-cement soffit including related accessories, in a quantity equal to 2 percent of amount installed.

1.9 Quality Assurance

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for fabrication and installation.
 - 1. Build mockups for fiber-cement soffit including accessories.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 Delivery, Storage, and Handling

- A. Deliver and store packaged materials in original containers with labels intact until time of use.
- B. Store materials on elevated platforms, under cover, and in a dry location.

1.11 Warranty

- A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including cracking and deforming.
 - b. Deterioration of materials beyond normal weathering.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

Part 2 Products

2.1 Manufacturers

- A. Source Limitations: Obtain products, including related accessories, from single source from single manufacturer.

2.2 Fiber-Cement Soffit

- A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.
- B. Nominal Thickness: Not less than 5/16 inch (8 mm).
- C. Pattern: 16-inch- (400-mm-) wide sheets with smooth texture.
- D. Ventilation: Provide perforated soffit
- E. Factory Priming: Manufacturer's standard acrylic primer.

2.3 Accessories

- A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.
 - 1. Provide accessories matching color and texture of adjacent siding unless otherwise indicated.
- B. Decorative Accessories: Provide the following fiber-cement decorative accessories as indicated:
 - 1. Fascia.
 - 2. Moldings and trim.
- C. Flashing: Provide stainless-steel flashing complying with Section 076200 "Sheet Metal Flashing and Trim" at window and door heads and where indicated.
- D. Fasteners:
 - 1. For fastening to wood, use siding nails of sufficient length to penetrate a minimum of 1 inch (25 mm) into substrate.
 - 2. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch (6 mm), or three screw-threads, into substrate.
 - 3. For fastening fiber cement, use stainless-steel fasteners.

- E. Insect Screening for Soffit Vents: Stainless steel, 18-by-18 (1.4-by-1.4-mm) mesh

Part 3 Execution

3.1 Examination

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of fiber-cement soffit and related accessories.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Preparation

- A. Clean substrates of projections and substances detrimental to application.

3.3 Installation

- A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
 - 1. Do not install damaged components.
 - 2. Install fasteners no more than 24 inches (600 mm) o.c.
- B. Install joint sealants as specified in Section 079200 "Joint Sealants" and to produce a weathertight installation.

3.4 Adjusting and Cleaning

- A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.
- B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION

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. Silicone joint sealants.
 - 2. Nonstaining silicone joint sealants.
 - 3. Urethane joint sealants.
 - 4. Immersible joint sealants.
 - 5. Silyl-terminated polyether joint sealants.
 - 6. Mildew-resistant joint sealants.
 - 7. Polysulfide joint sealants.
 - 8. Butyl joint sealants.
 - 9. Latex joint sealants.

1.3 Action Submittals

- A. Product Data: For each joint-sealant product.
- B. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.4 Informational Submittals

- A. Qualification Data: For qualified testing agency.

- B. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.
- C. Field-Adhesion-Test Reports: For each sealant application tested.
- D. Sample Warranties: For special warranties.

1.5 Quality Assurance

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

1.6 Field Conditions

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 Warranty

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

Part 2 Products

2.1 Joint Sealants, General

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 Silicone Joint Sealants

- A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
- B. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
- C. Silicone, S, NS, 35, NT: Single-component, nonsag, plus 35 percent and minus 35 percent movement capability. nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 35, Use NT.
- D. 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 C 920, Type S, Grade NS, Class 25, Use NT.
- E. Silicone, Acid Curing, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant: ASTM C 920, Type S, Grade NS, Class 25, Use NT.
- F. Silicone, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.

- G. Silicone, S, NS, 50, T, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Uses T and NT.
- H. Silicone, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Uses T and NT.
- I. Silicone, S, P, 100/50, T, NT: Single-component, pourable, plus 100 percent and minus 50 percent movement capability traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade P, Class 100/50, Uses T and NT.
- J. 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 C 920, Type S, Grade P, Class 25, Uses T and NT.
- K. Silicone, M, P, 100/50, T, NT: Multicomponent, pourable, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type M, Grade P, Class 100/50, Uses T and NT.

2.3 Nonstaining Silicone Joint Sealants

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.
- B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
- C. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
- D. Silicone, Nonstaining, S, NS, 100/50, T, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.
- E. Silicone, Nonstaining, M, NS, 50, NT: Nonstaining, multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type M, Grade NS, Class 50, Use NT.

2.4 Urethane Joint Sealants

- A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

- B. Urethane, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.
- C. Urethane, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Uses T and NT.
- D. Urethane, S, P, 35, T, NT: Single-component, pourable, plus 35 percent and minus 35 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade P, Class 35, Uses T and NT.
- E. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT.
- F. Urethane, M, NS, 50, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 50, Use NT.
- G. Urethane, M, NS, 25, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 25, Use NT.
- H. Urethane, M, NS, 50, T, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 50, Uses T and NT.
- I. Urethane, M, NS, 25, T, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 25, Uses T and NT.
- J. Urethane, M, P, 50, T, NT: Multicomponent, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade P, Class 50, Uses T and NT.
- K. Urethane, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade P, Class 25, Uses T and NT.

2.5 Immersible Joint Sealants

- A. Immersible Joint Sealants. Suitable for immersion in liquids; ASTM C 1247, Class 1; tested in deionized water unless otherwise indicated
- B. Urethane, Immersible, S, NS, 100/50, NT, I: Immersible, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses NT, and I.

- C. Urethane, Immersible, S, NS, 35, NT, I: Immersible, single-component, nonsag, plus 35 percent and minus 35 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 35, Use NT and I.
- D. Urethane, Immersible, S, NS, 50, T, NT, I: Immersible, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Uses T, NT, and I.
- E. Urethane, Immersible, S, NS, 35, T, NT, I: Immersible, single-component, nonsag, plus 35 percent and minus 35 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 35, Uses T, NT, and I.
- F. Urethane, Immersible, S, NS, 25, T, NT, I: Immersible, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Uses T, NT, and I.
- G. Urethane, Immersible, S, P, 50, T, NT, I: Immersible, single-component, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade P, Class 50, Uses T, NT, and I.
- H. Urethane, Immersible, S, P, 25, T, NT, I: Immersible, single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T, NT, and I.
- I. Polysulfide, Immersible, M, NS, 25, NT, I: Immersible, multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, polysulfide joint sealant; ASTM C 920, Type M, Grade NS, Class 25, Uses NT and I.
- J. Urethane, Immersible, M, NS, 50, T, NT, I: Immersible, multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 50, Uses T, NT, and I.
- K. Urethane, Immersible, M, NS, 25, T, NT, I: Immersible, multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 25, Uses T, NT, and I.
- L. Polysulfide, Immersible, M, NS, 25, T, NT, I: Immersible, multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, polysulfide joint sealant; ASTM C 920, Type M, Grade NS, Class 25, Uses T, NT, and I.
- M. Urethane, Immersible, M, P, 25, T, NT, I: Immersible, multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-

use, urethane joint sealant; ASTM C 920, Type M, Grade P, Class 25, Uses T, NT, and I.

2.6 Silyl-Terminated Polyether (STPE) Joint Sealants

- A. STPE, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
- B. STPE, S, NS, 35, NT: Single-component, nonsag, plus 35 percent and minus 35 percent movement capability, nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 35, Use NT.
- C. STPE, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
- D. STPE, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 100, Uses T and NT.
- E. STPE, S, NS, 50, T, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Uses T and NT.
- F. STPE, S, NS, 35, T, NT: Single-component, nonsag, plus 35 percent and minus 35 percent movement capability, traffic- and nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 35, Uses T and NT.
- G. STPE, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Uses T and NT.
- H. STPE, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT.

2.7 Mildew-Resistant Joint Sealants

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
- C. STPE, Mildew Resistant, S, NS, 50, NT: Mildew-resistant, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, silyl-

terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

2.8 Polysulfide Joint Sealants

- A. Polysulfide, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, polysulfide joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
- B. Polysulfide, M, NS, 25, T, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, polysulfide joint sealant; ASTM C 920, Type M, Grade NS, Class 25, Use NT.
- C. Polysulfide, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, polysulfide joint sealant; ASTM C 920, Type M, Grade P, Class 25, Uses T and NT.

2.9 Butyl Joint Sealants

- A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.

2.10 Latex Joint Sealants

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

2.11 Joint-Sealant Backing

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), Type B (bicellular material with a surface skin), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.12 Miscellaneous Materials

- A. 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.

- B. 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 joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

Part 3 Execution

3.1 Examination

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Preparation

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. 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.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, 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 after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Exterior insulation and finish systems.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of

interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

- a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer 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.

3.3 Installation Of Joint Sealants

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
 4. Provide flush joint profile at locations indicated on Drawings according to Figure 8B in ASTM C 1193.
 5. Provide recessed joint configuration of recess depth and at locations indicated on Drawings according to Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 Field Quality Control

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
 - b. Perform one test for each 1000 feet (300 m) of joint length thereafter or one test per each floor per elevation.
 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.

- b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
 4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
 5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 Cleaning

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 Protection

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 Joint-Sealant Schedule

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces
 1. Joint Locations:
 - a. Control and expansion joints in brick pavers.
 - b. Isolation and contraction joints in cast-in-place concrete slabs.

- c. Joints between plant-precaster architectural concrete paving units.
 - d. Joints in stone paving units, including steps.
 - e. Tile control and expansion joints.
 - f. Joints between different materials listed above.
 - g. Other joints as indicated on Drawings.
2. Joint Sealant: Urethane, M, P, 50, T, NT
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors
- B. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces subject to water immersion
1. Joint Locations:
 - a. Joints in pedestrian plazas.
 - b. Joints in swimming pool decks.
 - c. Other joints as indicated on Drawings.
 2. Joint Sealant: Urethane, immersible, S, P, 25, T, NT, I
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors
- C. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces
1. Joint Locations:
 - a. Construction joints in cast-in-place concrete.
 - b. Joints between plant-precaster architectural concrete units.
 - c. Control and expansion joints in unit masonry.
 - d. Joints in dimension stone cladding.
 - e. Joints in glass unit masonry assemblies.
 - f. Joints in exterior insulation and finish systems.
 - g. Joints between metal panels.

- h. Joints between different materials listed above.
 - i. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
 - j. Control and expansion joints in ceilings and other overhead surfaces.
 - k. Other joints as indicated on Drawings.
- 2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors
- D. Joint-Sealant Application: Interior joints in horizontal traffic surfaces
- 1. Joint Locations:
 - a. Isolation joints in cast-in-place concrete slabs.
 - b. Control and expansion joints in stone flooring.
 - c. Control and expansion joints in brick flooring.
 - d. Control and expansion joints in tile flooring.
 - e. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Urethane, S, P, 25, T, NT
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors
- E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces
- 1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Tile control and expansion joints.
 - c. Vertical joints on exposed surfaces of unit masonry, concrete, walls, and partitions.
 - d. Joints on underside of plant-precast structural concrete [beams] [and] [planks].
 - e. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, S, NS, 25, NT
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors
- F. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement
1. Joint Locations:
 - a. Control joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
 - c. Other joints as indicated on Drawings.
 2. Joint Sealant: Acrylic latex
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors
- G. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces
1. Joint Locations:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
 - c. Other joints as indicated on Drawings.
 2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors
- H. Joint-Sealant Application: Concealed mastics
1. Joint Locations:
 - a. Aluminum thresholds.
 - b. Sill plates.
 - c. Other joints as indicated on Drawings.

2. Joint Sealant: Butyl-rubber based
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors

END OF SECTION

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. Interior standard steel doors and frames.
 - 2. Exterior standard steel doors and frames.
 - 3. Interior custom hollow-metal doors and frames.
 - 4. Exterior custom hollow-metal doors and frames.
- B. Related Requirements:
 - 1. Division 08 Section "Door Hardware" for door hardware for hollow metal doors.
 - 2. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.
 - 3. Section 08 71 00 "Door Hardware"

1.3 Definitions

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.
- C. Custom Hollow Metal Work: Hollow metal work fabricated according HMMA 861.

1.4 Coordination

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.5 Preinstallation Meetings

- A. Preinstallation Conference: Conduct conference at Project site

1.6 Action Submittals

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
 - 7. Details of anchorages, joints, field splices, and connections.
 - 8. Details of accessories.
 - 9. Details of moldings, removable stops, and glazing.
- C. Samples for Initial Selection: For hollow-metal doors and frames with factory-applied color finishes.
- D. Samples for Verification:
 - 1. Finishes: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 127 mm).
 - 2. Fabrication: Prepare Samples approximately 12 by 12 inches (305 by 305 mm) to demonstrate compliance with requirements for quality of materials and construction:

- a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
 - b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.
- E. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.7 Informational Submittals

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.
- B. Oversize Construction Certification: For assemblies required to be fire-rated and exceeding limitations of labeled assemblies.

1.8 Delivery, Storage, And Handling

- A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.9 Quality Assurance

- A. Source Limitations: Obtain hollow metal work from single source, from single manufacturer.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockup of typical exterior wall area as shown on Drawings with waterproofing in place for review and approval by Architect and Bay District Schools Project Manager prior to door frame installation. Another review and approval of final installation of door frame is required prior to moving forward with other opening/door frame installation.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 Project Conditions

- A. Field Measurements: Verify actual dimensions of openings by field measurements.

Part 2 Products

2.1 Manufacturers

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 1. Ceco Door Products; an Assa Abloy Group company.
 2. Republic Builders Products.
 3. Steelcraft; an Ingersoll-Rand company

2.2 Performance Requirements

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 1. Smoke- and Draft-Control Assemblies: Provide assemblies with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
 3. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 4. Temperature-Rise Limit: Where indicated, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
- B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

- C. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.50 deg Btu/F x h x sq. ft. (2.84 W/K x sq. m) when tested according to ASTM C 518.
- D. Wind Loads: As indicated on Drawings.

2.3 Exterior Standard Steel Doors and Frames

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2; SDI A250.4, Level B. At locations indicated in the Door and Frame Schedule
 - 1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches (44.5 mm).
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch (1.0 mm), with minimum A40 (ZF120) coating.
 - d. Edge Construction: Model 2, Seamless.
 - e. Edge Bevel: Bevel lock edge 1/8 inch in 2 inches (3.2 mm in 51 mm)
 - f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
 - g. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
 - h. Core: Polyurethane
 - i. Fire-Rated Core: Manufacturer's standard vertical steel stiffener with insulation core for fire-rated doors.
 - 2. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A40 (ZF120) coating.
 - b. Construction: Face welded
 - 3. Exposed Finish: Prime

2.4 Interior Custom Hollow-Metal Doors and Frames

- A. Commercial Doors and Frames: NAAMM-HMMA 861; SDI A250.4, Physical Performance Level A. At locations indicated in the Door and Frame Schedule
1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches (44.5 mm).
 - c. Face: Cold-rolled steel sheet, minimum thickness of 0.042 inch (1.0 mm).
 - d. Edge Construction: Continuously welded with no visible seam.
 - e. Core: Steel stiffened.
 - f. Fire-Rated Core: Manufacturer's standard vertical steel stiffener core for fire-rated and temperature-rise-rated doors.
 2. Frames:
 - a. Materials: cold-rolled steel sheet, minimum thickness of 0.053 inch (1.3 mm), except 0.067 inch (1.7 mm) for openings exceeding 4 feet (1219 mm) wide.
 - b. Transom Frames: Fabricated from same material as adjacent door frame.
 - c. Construction: Face welded.
 3. Exposed Finish: Prime.

2.5 Frame Anchors

- A. Jamb Anchors:
1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches (610 mm) of frame height above 7 feet (2.1 m).
 3. Postinstalled Expansion Anchor: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
 4. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not

- less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
5. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
 6. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
- a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
- C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at top of underlayment.
- D. Material: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M; hot-dip galvanized according to ASTM A 153/A 153M, Class B postinstalled expansion anchors.

2.6 Materials

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- E. Power-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 hollow-metal frames of type indicated.
- F. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- G. Glazing: Comply with requirements in Section 08 80 00 "Glazing."

- H. Grout: ASTM C 476, except with a minimum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143 M.
- I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat.

2.7 Fabrication

- A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
 - 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors. Seal joints in top edges of doors against water penetration.
 - 2. Glazed Lites: Factory cut openings in doors.
- B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
 - 1. Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.
 - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
 - 4. Terminated Stops: Terminate stops 6 inches (152 mm) above finish floor with a 45 90-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.
 - 5. Welded Frames: weld flush face joints continuously, grind, fill, dress, and make smooth flush, and invisible.
 - 6. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.

- C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.
 3. Coordinate locations of conduit and wiring boxes for electrical connections with division 26 Electrical Section.
 4. Locate hardware as indicated or if not indicated, according to ANSI/SDI 250.0 and NAAMM-HMMA 861.
- D. Stops and Mouldings: corners of stops and moldings with butted or mitered hairline joints. Minimum 0.32 inches thick, fabricated from same material as door face sheet in which they are installed.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work, minimum 5/8" high unless otherwise indicated.
 2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 3. Provide loose stops and moldings on inside of hollow metal work. Minimum 0.32 inches thick, fabricated from same material as frames in which they are installed.
 4. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.8 Steel Finishes

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
- B. Factory Finish: Clean, pretreat, and apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, complying with SDI A250.3.
1. Color and Gloss: As selected by Architect from manufacturer's full range

Part 3 Execution

3.1 Examination

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Preparation

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
- C. Prior to installation, adjust and securely brace welded hollow metal frames alignment, twist, and plumbness to the following tolerances: for squareness,
 - 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

3.3 Installation

- A. General: Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
- B. Hollow-Metal Frames: Comply with SDI A250.11 and NAAMM-HMMA 840.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
 - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
 - b. Install frames with removable stops located on secure side of opening.
2. Fire-Rated Openings: Install frames according to NFPA 80.
3. Floor Anchors: Secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
4. Solidly pack mineral-fiber insulation inside frames.
5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
8. Install door silencers in frames before grouting.
9. Remove temporary braces necessary for installation only after frames have been properly set and secured.
10. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

- C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
 - 1. Non-Fire-Rated Steel Doors: Comply with SDI A250.8 NAAMM-HMMA 841 and NAAMM-HMMA guide specification indicated.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 - 3. Smoke-Control Doors: Install doors according to NFPA 105.

3.4 Cleaning and Touchup

- A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- C. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.
- D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.
- E. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable

END OF SECTION

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 access doors and frames for walls and ceilings.

1.3 Action Submittals

- A. Product Data: For each type of product.
 - 1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches (150 by 150 mm) in size.
- C. Product Schedule: For access doors and frames.

Part 2 Products

2.1 Access Doors and Frames

- A. Flush Access Doors with Concealed Flanges:
 - 1. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
 - 2. Locations: Wall and ceiling
 - 3. Uncoated Steel Sheet for Door: Nominal 0.060 inch (1.52 mm), 16 gage, factory primed.
 - 4. Frame Material: Same material and thickness as door.
 - 5. Latch and Lock: Cam latch, key operated.
- B. Exterior Flush Access Doors:
 - 1. Description: Weatherproof assembly, with face of door fit flush with frame and with exposed frame. Include extruded door gaskets and minimum 2-inch-thick (50-mm-thick) fiberglass insulation.

2. Locations: Wall
3. Uncoated Steel Sheet for Door: Nominal 0.036 inch (0.91 mm), 20 gage, factory primed.
4. Frame Material: Same material, thickness, and finish as door.
5. Latch and Lock: Cam latch operated by handle, with keyed lock in handle.

2.2 Materials

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- D. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666. Remove tool and die marks and stretch lines, or blend into finish.
- E. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063.
- F. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- G. Frame Anchors: Same material as door face.
- H. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.3 Fabrication

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.

2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded-metal lath and exposed casing bead welded to perimeter of frames.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.
1. For recessed doors with plaster infill, provide self-furring expanded-metal lath attached to door panel.
- E. Latch and Lock Hardware:
1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
 2. Keys: Furnish two keys per lock and key all locks alike.
- F. Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

2.4 Finishes

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

Part 3 Execution

3.1 Examination

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation

- A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 Adjusting

- A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION

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 doors.
- B. Related Requirements:
 - 1. Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting" for finish painting of factory-primed doors.

1.3 Action Submittals

- A. Product Data: For each type and size of overhead coiling door and accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
 - 3. Include description of automatic closing device and testing and resetting instructions.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
 - 4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.

5. Show locations of controls, locking devices, detectors or replaceable fusible links, and other accessories.
 6. Include diagrams for power, signal, and control wiring.
- C. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:
1. Curtain slats.
 2. Bottom bar with sensor edge.
 3. Guides.
 4. Brackets.
 5. Hood.
 6. Locking device(s).
 7. Include similar Samples of accessories involving color selection.

1.4 Informational Submittals

- A. Qualification Data: For Installer.
- B. Oversize Construction Certification: For door assemblies required to be fire-rated and that exceed size limitations of labeled assemblies.

1.5 Closeout Submittals

- A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.6 Quality Assurance

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
 1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

Part 2 Products

2.1 Manufacturers, General

- A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.

1. Obtain operators and controls from overhead coiling door manufacturer.

2.2 Performance Requirements

- A. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
 1. Design Wind Load: As indicated on Drawings.
 2. Testing: According to ASTM E 330.
 3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
 4. Operability under Wind Load: Design overhead coiling doors to remain operable under design wind load, acting inward and outward.
- B. Windborne-Debris Impact Resistance: Provide impact-protective overhead coiling doors that pass missile-impact and cyclic-pressure tests according to design wind load and code criteria.
 1. Large-Missile Test: For overhead coiling doors located within 30 feet (9.144 m) of grade.
 2. Small-Missile Test: For overhead coiling doors located more than 30 feet (9.144 m) above grade.

2.3 Door Assembly

- A. Service and Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
- B. Operation Cycles: Door components and operators capable of operating for not less than 50,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
 1. Include tamperproof cycle counter.
- C. Air Infiltration: Maximum rate of 1.0 cfm/sq. ft. (5.1 L/s per sq. m) at 15 and 25 mph (24.1 and 40.2 km/h) when tested according to ASTM E 283 or DASMA 105.
- D. Curtain R-Value: 4.5 deg F x h x sq. ft./Btu (0.792 K x sq. m/W)
- E. Door Curtain Material: Aluminum.
- F. Door Curtain Slats: Curved or Flat profile slats of 1-7/8-inch (48-mm) center-to-center height.
 1. Insulated-Slat Interior Facing: Metal.

2. Gasket Seal. Manufacturer's standard continuous gaskets between slats.
- G. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch (38 by 38 by 3 mm) thick; fabricated from hot-dip galvanized steel, stainless steel or aluminum extrusions and finished to match door.
- H. Curtain Jamb Guides: Aluminum with exposed finish matching curtain slats.
- I. Hood: Match curtain material and finish.
- J. Locking Devices: As directed by Owner
- K. Electric Door Operator:
1. Usage Classification: Standard duty, up to 25 cycles per hour and up to 90 cycles per day
 2. Operator Location: Top of hood
 3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 feet (2.44 m) or lower.
 4. Motor Exposure: Interior
 5. Emergency Manual Operation: Push-up type.
 6. Obstruction-Detection Device: Automatic photoelectric sensor
 - a. Sensor Edge Bulb Color: As selected by Architect from manufacturer's full range
 7. Control Station(s): Exterior mounted
- L. Door Finish:
1. Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.
 2. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.
 3. Interior Curtain-Slat Facing: Finish as selected by Architect from manufacturer's full range.

2.4 Door Curtain Materials and Construction

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and

mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 (Z275) zinc coating; nominal sheet thickness (coated) of 0.028 inch (0.71 mm); and as required.
 2. Stainless-Steel Door Curtain Slats: ASTM A 666, Type 304; sheet thickness of 0.025 inch (0.64 mm); and as required.
 3. Aluminum Door Curtain Slats: ASTM B 209 (ASTM B 209M) sheet or ASTM B 221 (ASTM B 221M) extrusions, alloy and temper standard with manufacturer for type of use and finish indicated; thickness of 0.050 inch (1.27 mm); and as required.
 4. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84 or UL 723. Enclose insulation completely within slat faces.
 5. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face, with minimum steel thickness of 0.010 inch (0.25 mm) and minimum aluminum thickness of 0.032 inch (0.80 mm).
- B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.5 Hoods

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
1. Galvanized Steel: Nominal 0.028-inch- (0.71-mm-) thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653/A 653M.
 2. Stainless Steel: 0.025-inch- (0.64-mm-) thick stainless-steel sheet, Type 304, complying with ASTM A 666.
 3. Aluminum: 0.040-inch- (1.02-mm-) thick aluminum sheet complying with ASTM B 209 (ASTM B 209M), of alloy and temper recommended by manufacturer and finisher for type of use and finish indicated.

4. Exterior-Mounted Doors: Fabricate hood to act as weather protection and with a perimeter sealant-joint-bead profile for applying joint sealant.

2.6 Locking Devices

- A. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.7 Curtain Accessories

- A. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.
 1. At door head, use 1/8-inch- (3-mm-) thick, replaceable, continuous-sheet baffle secured to inside of hood or field- installed on the header.
 2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch- (3-mm-) thick seals of flexible vinyl, rubber, or neoprene.
- B. Astragal for Interior Doors: Equip each door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.
- C. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.
- D. Pull-Down Strap: Provide pull-down straps for doors more than 84 inches (2130 mm) high.
- E. Pole Hooks: Provide pole hooks and poles for doors more than 84 inches (2130 mm) high.

2.8 Counterbalancing Mechanism

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.9 General Finish Requirements

- A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.

- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.10 Aluminum Finishes

- A. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, application, and baking.

Part 3 Execution

3.1 Examination

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.
- C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.3 Adjusting

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
 - 1. Adjust exterior doors and components to be weather-resistant.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter.

3.4 Maintenance Service

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of coiling-

door Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Perform maintenance, including emergency callback service, during normal working hours.
2. Include 24-hour-per-day, seven-day-per-week, emergency callback service.

3.5 Demonstration

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION

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 aluminum windows for exterior locations.

1.3 Preinstallation Meetings

- A. Preinstallation Conference: Conduct conference at Project site
 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 2. Review and discuss the finishing of aluminum windows that is required to be coordinated with the finishing of other aluminum work for color and finish matching.
 3. Review, discuss, and coordinate the interrelationship of aluminum windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
 4. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
 5. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.4 Action Submittals

- A. Product Data: For each type of product.
 1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.
- B. Shop Drawings: For aluminum windows.
 1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

- C. Samples: For each exposed product and for each color specified, 2 by 4 inches (50 by 100 mm) in size.
- D. Samples for Initial Selection: For units with factory-applied finishes.
 - 1. Include Samples of hardware and accessories involving color selection.
- E. Samples for Verification: For aluminum windows and components required, showing full range of color variations for finishes, and prepared on Samples of size indicated below:
 - 1. Exposed Finishes: 2 by 4 inches (50 by 100 mm)
 - 2. Exposed Hardware: Full-size units.
- F. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

1.5 Informational Submittals

- A. Qualification Data: For manufacturer and Installer.
- B. Product Test Reports: For each type of aluminum window, for tests performed by a qualified testing agency.
- C. Field quality-control reports.
- D. Sample Warranties: For manufacturer's warranties.

1.6 Quality Assurance

- A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.
- B. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.
- C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockup of typical wall area as shown on Drawings with waterproofing in place for review and approval by Architect and Bay District Schools Project Manager prior to window installation. Another review and approval of final installation of window is required prior to moving forward with other opening/window installation.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 Warranty

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Failure to meet performance requirements.
 - b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
 - c. Faulty operation of movable sash and hardware.
 - d. Deterioration of materials and finishes beyond normal weathering.
 - e. Failure of insulating glass.
 2. Warranty Period:
 - a. Window: 10 years from date of Substantial Completion.
 - b. Glazing Units: 20 years from date of Substantial Completion.
 - c. Aluminum Finish: 20 years from date of Substantial Completion.

Part 2 Products

2.1 Manufacturers

- A. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

2.2 Window Performance Requirements

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 1. Window Certification: AAMA certified with label attached to each window.
- B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

1. Minimum Performance Grade: As indicated on Drawings.
- C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.50 Btu/sq. ft. x h x deg F (3.43 W/sq. m x K)
- D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.25
- E. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 45
- F. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 1. Temperature Change: 120 deg F (67 deg C) ambient; 180 deg F (100 deg C) material surfaces
- G. Sound Transmission Class (STC): Rated for not less than 30 STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.
- H. Outside-Inside Transmission Class (OITC): Rated for not less than 30 OITC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.

2.3 Aluminum Windows

- A. Operating Types: Provide the following operating types in locations indicated on Drawings:
 1. Fixed.
- B. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.
 1. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.
- C. Glass: Clear annealed glass, ASTM C 1036, Type 1, Class 1, q3.
 1. Kind: Fully tempered
- D. Insulating-Glass Units: ASTM E 2190.

1. Exterior Lite: ASTM C 1036, Type 1, Class 1, q3.
 - a. Tint: As selected by Architect.
 - b. Kind: Fully tempered.
 2. Interior Lite: ASTM C 1172 clear laminated glass with two plies of float glass.
 - a. Float Glass: Fully tempered
 - b. Interlayer Thickness: As required by performance requirements indicated
 3. Filling: Fill space between glass lites with air.
 4. Low-E Coating: Sputtered on second or third surface.
- E. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal
1. Dual Glazing System:
 - a. Interior Lite: Glass
 - b. Exterior Lite: Insulating-glass unit
- F. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.4 Accessories

- A. Subsills: Thermally broken, extruded-aluminum subsills in configurations indicated on Drawings.
- B. Interior Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.
- C. Panning Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.
- D. Receptor System: Two-piece, snap-together, thermally broken, extruded-aluminum receptor system that anchors windows in place.

2.5 Fabrication

- A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.
- B. Glaze aluminum windows in the factory.
- C. Weather strip each operable sash to provide weathertight installation.
- D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.
- E. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.
- F. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units.
- G. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.6 General Finish Requirements

- A. Comply with NAAMM's "Metal Finishes Manual" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 Aluminum Finishes

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. High-Performance Organic Finish (Three-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coatings; Organic Coating: manufacturer's standard three-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and

apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from full range of industry colors and color densities

Part 3 Execution

3.1 Examination

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.
- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.
- C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
- D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 Field Quality Control

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
- B. Testing Services: Testing and inspecting of installed windows shall take place as follows:

1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502.
 2. Air-Infiltration Testing:
 - a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
 - b. Allowable Air-Leakage Rate: 1.5 times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.
 3. Water-Resistance Testing:
 - a. Test Pressure: Two-thirds times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
 - b. Allowable Water Infiltration: No water penetration.
 4. Testing Extent: Three windows of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested after perimeter sealants have cured.
 5. Test Reports: Prepared according to AAMA 502.
- C. Windows will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.4 Adjusting, Cleaning, and Protection

- A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.
- B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
 1. Keep protective films and coverings in place until final cleaning.
- C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION

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. Mechanical door hardware for the following:
 - a. Swinging doors.
 - 2. Cylinders for door hardware specified in other Sections.

1.3 Coordination

- A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

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.
- B. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Format: Use same scheduling sequence and format as in door hardware schedule in the Contract Documents.
- C. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.5 Informational Submittals

- A. Product Certificates: For each type of electrified door hardware.
 - 1. Certify that door hardware for use on each type and size of labeled fire-rated doors complies with listed fire-rated door assemblies.
- B. Product Test Reports: For compliance with accessibility requirements, for tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.
- C. Field quality-control reports.
- D. Sample Warranty: For special warranty.

1.6 Closeout Submittals

- A. Maintenance Data: For each type of door hardware to include in maintenance manuals.

1.7 Quality Assurance

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.
 - 1. Warehousing Facilities: In Project's vicinity.
 - 2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
 - 3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Hardware Consultant (AHC).

1.8 Delivery, Storage, and Handling

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

- C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.
- D. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.9 Warranty

- A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of doors and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 - 2. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:
 - a. Exit Devices: Two years from date of Substantial Completion.

Part 2 Products

2.1 Manufacturers

- A. Source Limitations: Obtain each type of door hardware from single manufacturer.
 - 1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.2 Performance Requirements

- A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
- B. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

2.3 Scheduled Door Hardware

- A. Provide products for each door that comply with requirements indicated in Part 2 and door hardware schedule.
- B. Coordinate with Owner on desired hardware and security requirements.
- C. Hardware is to match existing hardware in the new courthouse addition.

2.4 Hinges

- A. Hinges: BHMA A156.1.

2.5 Self-Closing Hinges and Pivots

- A. Self-Closing Hinges and Pivots: BHMA A156.17.

2.6 Mechanical Locks and Latches

- A. Lock Functions: As indicated in door hardware schedule.
- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 - 1. Bored Locks: Minimum 1/2-inch (13-mm) latchbolt throw.
 - 2. Mortise Locks: Minimum 3/4-inch (19-mm) latchbolt throw.
- C. Lock Backset: 2-3/4 inches (70 mm) unless otherwise indicated.
- D. Lock Trim:
 - 1. Description: Match existing
 - 2. Levers: Match existing.
 - 3. Escutcheons (Roses): Match existing.
 - 4. Dummy Trim: Match lever lock trim and escutcheons.
- E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
 - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.

- 3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
 - 4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.
- F. Bored Locks: BHMA A156.
 - G. Mortise Locks: BHMA A156.13
 - H. Interconnected Locks: BHMA A156.12
 - I. Roller Latches: BHMA A156.16; Grade 1; rolling plunger that engages socket or catch, with adjustable roller projection.
- 2.7 Exit Locks and Exit Alarms**
- A. Exit Locks and Alarms: BHMA A156.29, Grade 1.
- 2.8 Surface Bolts**
- A. Surface Bolts: BHMA A156.16.
- 2.9 Manual Flush Bolts**
- A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge.
- 2.10 Automatic and Self-Latching Flush Bolts**
- A. Automatic and Self-Latching Flush Bolts: BHMA A156.16; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge.
- 2.11 Exit Devices and Auxiliary Items**
- A. Exit Devices and Auxiliary Items: BHMA A156.3.
- 2.12 Lock Cylinders**
- A. Lock Cylinders: Match existing.
 - B. Standard Lock Cylinders: BHMA A156.5;
 - C. Core Type: Match existing.
- 2.13 Keying**
- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, appendix. Provide one extra key blank for each lock.

1. Existing System:

- a. Master key or grand master key locks to Owner's existing system.

B. Keys: Match existing.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

- a. Notation: "DO NOT DUPLICATE."

2.14 Operating Trim

- A. Operating Trim: BHMA A156.6

2.15 Surface Closers

- A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

2.16 Concealed Closers

- A. Concealed Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

2.17 Overhead Stops and Holders

- A. Overhead Stops and Holders: BHMA A156.8.

2.18 Door Gasketing

- A. Door Gasketing: BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
- B. Maximum Air Leakage: When tested according to ASTM E 283 with tested pressure differential of 0.3-inch wg (75 Pa), as follows:
 1. Smoke-Rated Gasketing: 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) of door opening.
 2. Gasketing on Single Doors: 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) of door opening.

3. Gasketing on Double Doors: 0.50 cfm per foot (0.000774 cu. m/s per m) of door opening.

2.19 Thresholds

- A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

2.20 Fabrication

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

- B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

- C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

2. Fire-Rated Applications:

- a. Wood or Machine Screws: For the following:

- 1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
- 2) Strike plates to frames.
- 3) Closers to doors and frames.

- b. Steel Through Bolts: For the following unless door blocking is provided:

- 1) Surface hinges to doors.
- 2) Closers to doors and frames.

- 3) Surface-mounted exit devices.
3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.21 Finishes

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

Part 3 Execution

3.1 Examination

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Preparation

- A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

3.3 Installation

- A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
 1. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces

that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Lock Cylinders: Install construction cores to secure building and areas during construction period.
- E. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
- F. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- G. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
1. Do not notch perimeter gasketing to install other surface-applied hardware.
- H. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- I. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 Field Quality Control

- A. Independent Architectural Hardware Consultant: Engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 Adjusting

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 Cleaning and Protection

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 Maintenance Service

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

END OF SECTION

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. Glass for window. Doors and storefront framing
 - 2. Glazing sealants and accessories.

1.3 Definitions

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

1.4 Coordination

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 Action Submittals

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass 12 inches (300 mm) square.
- C. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch (300-mm) lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

- E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 Informational Submittals

- A. Qualification Data: For Installer, manufacturers of insulating-glass units with sputter-coated, low-E coatings, glass testing agency, and sealant testing agency.
- B. Product Certificates: For glass.
- C. Product Test Reports: For tinted glass, coated glass, insulating glass and glazing sealants, for tests performed by a qualified testing agency.
 - 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- D. Preconstruction adhesion and compatibility test report.
- E. Sample Warranties: For special warranties.

1.7 Quality Assurance

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.
- B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

1.8 Preconstruction Testing

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - 1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 - 2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of

glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.

3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.9 Delivery, Storage, And Handling

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 Field Conditions

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F (4.4 deg C).

1.11 Warranty

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge

separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years from date of Substantial Completion.
- C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
1. Warranty Period: 10 years from date of Substantial Completion.

Part 2 Products

2.1 Manufacturers

- A. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
1. Obtain tinted glass from single source from single manufacturer.
 2. Obtain reflective-coated glass from single source from single manufacturer.
- B. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 Performance Requirements

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.
1. Design Wind Pressures: As indicated on Drawings.
 2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch (25 mm), whichever is less.

3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- D. Windborne-Debris-Impact Resistance: Exterior glazing shall comply with design pressures on drawings and code requirements.
1. Large-Missile Test: For glazing located within 30 feet (9.1 m) of grade.
 2. Small-Missile Test: For glazing located more than 30 feet (9.1 m) above grade.
- E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
 2. For laminated-glass lites, properties are based on products of construction indicated.
 3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
 5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 Glass Products, General

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
 3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."

4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
 - C. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
 1. Minimum Glass Thickness for Exterior Lites: 6 mm.
 2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
 - D. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 Glass Products

- A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.
- B. Ultraclear Float Glass: ASTM C 1036, Type I, Class I (clear), Quality-Q3; and with visible light transmission of not less than 91 percent and solar heat gain coefficient of not less than 0.87.
- C. Tinted Annealed Float Glass: ASTM C 1036, Type I, Class 2 (tinted), Quality-Q3.
- D. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- E. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

- F. Pyrolytic-Coated, Low-Maintenance Glass: Clear float glass with a coating on first surface having both photocatalytic and hydrophilic properties that act to loosen dirt and to cause water to sheet evenly over the glass instead of beading.
- G. Ceramic-Coated Vision Glass: ASTM C 1048, Condition C, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3; and complying with Specification No. 95-1-31 in GANA's "Engineering Standards Manual."
- H. Reflective-Coated Vision Glass: ASTM C 1376.

2.5 Laminated Glass

- A. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
 - 1. Construction: Laminate glass with ionomeric polymer interlayer or cast-in-place and cured-transparent-resin interlayer to comply with interlayer manufacturer's written instructions.
 - 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 - 3. Interlayer Color: Clear unless otherwise indicated.
- B. Windborne-Debris-Impact-Resistant Laminated Glass: Comply with requirements specified above for laminated glass except laminate glass with one of the following to comply with interlayer manufacturer's written instructions:
 - 1. Polyvinyl butyral interlayer.
 - 2. Polyvinyl butyral interlayers reinforced with polyethylene terephthalate film.
 - 3. Ionomeric polymer interlayer.
 - 4. Cast-in-place and cured-transparent-resin interlayer.
 - 5. Cast-in-place and cured-transparent-resin interlayer reinforced with polyethylene terephthalate film.

2.6 Insulating Glass

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
 - 1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
 - 2. Perimeter Spacer: Manufacturer's standard spacer material and construction.

3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.7 Glazing Sealants

A. General:

1. **Compatibility:** Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. **Suitability:** Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. **Colors of Exposed Glazing Sealants:** As indicated by manufacturer's designations

B. **Glazing Sealant:** Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

C. **Glazing Sealant:** Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.

D. **Glazing Sealant:** Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.

E. **Glazing Sealant:** Acid-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.

2.8 Glazing Tapes

A. **Back-Bedding Mastic Glazing Tapes:** Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. **Expanded Cellular Glazing Tapes:** Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.9 Miscellaneous Glazing Materials

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.10 Fabrication of Glazing Units

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

Part 3 Execution

3.1 Examination

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep systems.
 - 3. Minimum required face and edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Preparation

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 Glazing, General

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

- F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 Tape Glazing

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.

- G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 Gasket Glazing (Dry)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 Sealant Glazing (Wet)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 Cleaning And Protection

- A. Immediately after installation remove nonpermanent labels and clean surfaces.

- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION

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 the following types of silvered flat glass mirrors:
 - 1. Tempered glass mirrors qualifying as safety glazing.
- B. Related Requirements:
 - 1. Section 10 28 00 "Toilet, Bath, and Laundry Accessories" for metal-framed mirrors.

1.3 Action Submittals

- A. Product Data: For each type of product.
- B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachment details.
- C. Samples: For each type of the following:
 - 1. Mirrors: 12 inches (300 mm) square, including edge treatment on two adjoining edges.
 - 2. Mirror Clips: Full size.
 - 3. Mirror Trim: 12 inches (300 mm) long.

1.4 Informational Submittals

- A. Sample Warranty: For special warranty.

1.5 Closeout Submittals

- A. Maintenance Data: For mirrors to include in maintenance manuals.

1.6 Preconstruction Testing

- A. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing.

1.7 Delivery, Storage, And Handling

- A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.8 Warranty

- A. Special Warranty: Manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

1. Warranty Period: Five years from date of Substantial Completion.

Part 2 Products

2.1 Manufacturers

- A. Source Limitations for Mirror Accessories: Obtain mirror glazing accessories from single source.

2.2 Silvered Flat Glass Mirrors

- A. Mirrors, General: ASTM C 1503
- B. Tempered Glass Mirrors: Mirror Glazing Quality for blemish requirements and complying with ASTM C 1048 for Kind FT, Condition A, tempered float glass before silver coating is applied
 1. Nominal Thickness: 6.0 mm
- C. Safety Glazing Products: For tempered mirrors, provide products that comply with 16 CFR 1201, Category II.

2.3 Miscellaneous Materials

- A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.
- C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.
- D. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

2.4 Mirror Hardware

- A. Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover edges of mirrors in a single piece.
 - 1. Bottom and Side Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch (9.5 and 22 mm) in height, respectively, and a thickness of not less than 0.04 inch (1.0 mm).
 - 2. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch (16 and 25 mm) in height, respectively, and a thickness of not less than 0.04 inch (1.0 mm).
 - 3. Finish: Clear bright anodized.
- B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

2.5 Fabrication

- A. Fabricate mirrors in the shop to greatest extent possible.
- B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.
- C. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint, as recommended in writing by film-backing manufacturer, to produce a surface free of bubbles, blisters, and other imperfections.

Part 3 Execution

3.1 Examination

- A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.
- B. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers with mirror mastic.
- C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 Preparation

- A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 Installation

- A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
- B. Provide a minimum airspace of 1/8 inch (3 mm) between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.
- C. Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.

3.4 Cleaning and Protection

- A. Protect mirrors from breakage and contaminating substances resulting from construction operations.
- B. Do not permit edges of mirrors to be exposed to standing water.
- C. Maintain environmental conditions that prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.
- D. Clean exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Clean mirrors as recommended in writing by mirror manufacturer.

END OF SECTION

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. Interior gypsum board.
2. Exterior gypsum board for ceilings and soffits.
3. Tile backing panels.

- B. Related Requirements:

1. Section 09 30 13 "Ceramic Tiling" for cementitious backer units installed as substrates for ceramic tile.

1.3 Action Submittals

- A. Product Data: For each type of product.

1.4 Quality Assurance

- A. Mockups: Build mockups of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
2. Simulate finished lighting conditions for review of mockups.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 Delivery, Storage and Handling

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 Field Conditions

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

Part 2 Products

2.1 Performance Requirements

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 Gypsum Board, General

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 Interior Gypsum Board

- A. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8 inch (15.9 mm).
 - 2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
- B. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
 - 1. Thickness: 1/2 inch (12.7 mm).
 - 2. Long Edges: Tapered.
- C. Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch (15.9 mm), Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 Specialty Gypsum Board

- A. Glass-Mat Interior Gypsum Board: ASTM C 1658/C 1658M. With fiberglass mat laminated to both sides. Specifically designed for interior use.
1. Core: 5/8 inch (15.9 mm), Type X
 2. Long Edges: Tapered.
 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 Exterior Gypsum Board for Ceilings and Soffits

- A. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M, with fiberglass mat laminated to both sides and with manufacturer's standard edges.
1. Core: As indicated

2.6 Tile Backing Panels

- A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.
1. Core: 5/8 inch (15.9 mm), Type X.
 2. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- B. Water-Resistant Gypsum Backing Board: ASTM C 1396/C 1396M, with manufacturer's standard edges.
1. Core: 5/8 inch (15.9 mm), Type X

2.7 Trim Accessories

- A. Interior Trim: ASTM C 1047.
1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet
- B. Exterior Trim: ASTM C 1047.

1. Material: Hot-dip galvanized-steel sheet, plastic, or rolled zinc
- C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
1. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
 2. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified

2.8 Joint Treatment Materials

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
1. Interior Gypsum Board: Paper.
 2. Exterior Gypsum Soffit Board: Paper.
 3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
 4. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
- D. Joint Compound for Exterior Applications:
1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
 2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.
- E. Joint Compound for Tile Backing Panels:
1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
 2. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

2.9 Auxiliary Materials

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

- C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

Part 3 Execution

3.1 Examination

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Applying and Finishing Panels, General

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on

opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless 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. (0.7 sq. m) in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 Applying Interior Gypsum Board

- A. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) or horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

- a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- B. Multilayer Application:
1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
 2. On partitions/walls, apply gypsum board indicated for 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 unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 3. On Z-shaped 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.
 4. Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners.
- C. Laminating 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 written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.4 Applying Exterior Gypsum Panels for Ceilings And Soffits

- A. Apply panels perpendicular to supports, with end joints staggered and located over supports.
1. Install with 1/4-inch (6.4-mm) open space where panels abut other construction or structural penetrations.
 2. Fasten with corrosion-resistant screws.

3.5 Applying Tile Backing Panels

- A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
- B. Water-Resistant Backing Board: Install where indicated with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
- C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.6 Installing Trim Accessories

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

3.7 Finishing Gypsum Board

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Panels that are substrate for tile.
 - 3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
- E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

- F. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

3.8 Protection

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

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. Ceramic mosaic tile.
2. Quarry tile.
3. Pressed floor tile.
4. Porcelain tile.
5. Glazed wall tile.
6. Stone thresholds.
7. Tile backing panels.
8. Waterproof membrane for thin set applications.
9. Crack isolation membrane.
10. Metal edge strips.

- B. Related Requirements:

1. Section 07 92 00 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Section 09 29 00 "Gypsum Board" for glass-mat, water-resistant backer board.

1.3 Definitions

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13,

ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."

- C. Module Size: Actual tile size plus joint width indicated.
- D. Face Size: Actual tile size, excluding spacer lugs.

1.4 Action Submittals

- A. Product Data: For each type of product.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Initial Selection: For tile, grout, and accessories involving color selection.

1.5 Informational Submittals

- A. Qualification Data: For Installer.
- B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- C. Product Certificates: For each type of product.
- D. Product Test Reports: For tile-setting and -grouting products and certified porcelain tile.

1.6 Maintenance Material Submittals

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
 - 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.7 Delivery, Storage, and Handling

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

1.8 Field Conditions

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

Part 2 Products

2.1 Manufacturers

- A. Source Limitations for Tile: Obtain tile from single source or producer.
 - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
 - 1. Stone thresholds.
 - 2. Waterproof membrane.
 - 3. Crack isolation membrane.
 - 4. Cementitious backer units.
 - 5. Metal edge strips.

2.2 Products, General

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

2.3 Tile Products

- A. Ceramic Tile Type: Glazed wall tile.
 - 1. Face Size Variation: Rectified.
 - 2. Thickness: 5/16 inch (8 mm).
 - 3. Tile Color and Pattern: As selected by Architect from manufacturer's full range
 - 4. Grout Color: As selected by Architect from manufacturer's full range
 - 5. Mounting: Factory, back mounted.
 - 6. Mounting: PregROUTED sheets of tiles are factory assembled and grouted with manufacturer's standard white silicone rubber.
 - 7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
 - a. Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining flat tile.
 - b. External Corners for Portland Cement Mortar Installations: Bullnose shape with radius of at least 3/4 inch (19 mm) unless otherwise indicated.
 - c. External Corners for Thinset Mortar Installations: Surface bullnose, same size as adjoining flat tile.
 - d. Internal Corners: Field-butt square corners. For covered base and cap use angle pieces designed to fit with stretcher shapes.

2.4 Tile Backing Panels

- A. Fiber-Cement Backer Board: ASTM C 1288, in maximum lengths available to minimize end-to-end butt joints.
 - 1. Thickness: As indicated.

2.5 Setting Materials

- A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.
1. Cleavage Membrane: Asphalt felt, ASTM D 226/D 226M, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils (0.1 mm) thick.
 2. Reinforcing Wire Fabric: Galvanized, welded-wire fabric, 2 by 2 inches (50.8 by 50.8 mm) by 0.062-inch (1.57-mm) diameter; comply with ASTM A 185/A 185M and ASTM A 82/A 82M, except for minimum wire size.
 3. Expanded Metal Lath: Diamond-mesh lath complying with ASTM C 847.
 - a. Base Metal and Finish for Interior Applications: Uncoated or zinc-coated (galvanized) steel sheet, with uncoated steel sheet painted after fabrication into lath.
 - b. Base Metal and Finish for Exterior Applications: Zinc-coated (galvanized) steel sheet.
 - c. Configuration over Studs and Furring: Flat.
 - d. Configuration over Solid Surfaces: Self-furring.
 4. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.
- B. Standard Dry-Set Mortar (Thinset): ANSI A118.1.
1. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.1.
- C. Modified Dry-Set Mortar (Thinset): ANSI A118.4.
1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
- D. Medium-Bed, Modified Dry-Set Mortar: Comply with requirements in ANSI A118.4. Provide product that is approved by manufacturer for application thickness of 5/8 inch (16 mm)
1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
- E. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15.

1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.15.
- F. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3.
1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F (60 and 100 deg C), respectively, and certified by manufacturer for intended use.
- G. Organic Adhesive: ANSI A136.1, Type I.

2.6 Grout Materials

- A. Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated.
- B. Standard Cement Grout: ANSI A118.6.
- C. High-Performance Tile Grout: ANSI A118.7.
1. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.
- D. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less.
1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F (60 and 100 deg C), respectively, and certified by manufacturer for intended use.
- E. Grout for PregROUTed Tile Sheets: Same product used in factory to pregROUT tile sheets.

2.7 Miscellaneous Materials

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.
- C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.8 Mixing Mortars and Grout

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

Part 3 Execution

3.1 Examination

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify that concrete substrates for tile floors installed with adhesives bonded mortar bed or thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 - 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 - 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Preparation

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 Ceramic Tile Installation

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
- F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
 - 1. Pressed Floor Tile: 1/4 inch (6.4 mm)

2. Glazed Wall Tile: 1/16 inch (1.6 mm)
- H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
 - I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
 - J. Metal Edge Strips: Install [where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

3.4 Tile Backing Panel Installation

- A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use modified dry-set mortar for bonding material unless otherwise directed in manufacturer's written instructions.

3.5 Adjusting and Cleaning

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 1. Remove grout residue from tile as soon as possible.
 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.6 Protection

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION

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. Thermoset-rubber base.

1.3 Action Submittals

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches (300 mm) long.

1.4 Maintenance Material Submittals

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 Delivery, Storage, And Handling

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.6 Field Conditions

- A. Install resilient products after other finishing operations, including painting, have been completed.

Part 2 Products

2.1 Thermoset-Rubber Base

- A. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
 - 1. Style and Location:
 - a. See Finish Schedule for selection.

2.2 Installation Materials

- A. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

Part 3 Execution

3.1 Examination

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 Preparation

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 Resilient Base Installation

- A. Comply with manufacturer's written instructions for installing resilient base.

- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.
 - a. Form without producing discoloration (whitening) at bends.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.

3.4 Cleaning and Protection

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum horizontal surfaces thoroughly.
 - 3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

END OF SECTION

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 surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Concrete.
 - 2. Steel.
 - 3. Galvanized metal.
 - 4. Aluminum (not anodized or otherwise coated).
 - 5. Wood.
- B. Related Sections include the following:
 - 1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
 - 2. Division 06 Sections for shop priming carpentry with primers specified in this Section.
 - 3. Division 09 painting Sections for special-use coatings.
 - 4. Division 09 Section "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

1.3 Submittals

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of topcoat product indicated.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat indicated.
 - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 - 2. Step coats on Samples to show each coat required for system.

3. Label each coat of each Sample.
 4. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.4 Quality Assurance

- A. MPI Standards:
1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List".
 2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.
- B. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - b. Other Items: Architect will designate items or areas required.
 2. Final approval of color selections will be based on benchmark samples.
 - a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.5 Delivery, Storage, And Handling

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.6 Project Conditions

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints in snow, rain, fog, or mist; when 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.

1.7 Extra Materials

- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
 - 1. Quantity: Furnish an additional 1 gal. of each material and color applied.

Part 2 Products

2.1 Manufacturers

- 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:
 - 1. Benjamin Moore & Co.
 - 2. BLP Mobile Paint Manufacturing.
 - 3. ChemRex.
 - 4. Columbia Paint & Coatings.
 - 5. Coronado Paint.
 - 6. Davis Paint Company.
 - 7. Duron, Inc.
 - 8. ICI Paints.
 - 9. Porter Paints.
 - 10. PPG Architectural Finishes, Inc.
 - 11. Sherwin-Williams Company (The).
 - 12. Vista Paint.

2.2 Paint, General

- A. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. Colors: As selected by Architect from manufacturer's full range.

2.3 Block Fillers

- A. Interior/Exterior Latex Block Filler: MPI #4.
 - 1. VOC Content: E Range of E2.

2.4 Primers/Sealers

- A. Bonding Primer (Solvent Based): MPI #69.
 - 1. VOC Content: E Range of E2.
- B. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint system indicated.

2.5 Metal Primers

- A. Quick-Drying Alkyd Metal Primer: MPI #76.
 - 1. VOC Content: E Range of E2.
- B. Cementitious Galvanized-Metal Primer: MPI #26.
 - 1. VOC Content: E Range of E1.
- C. Quick-Drying Primer for Aluminum: MPI #95.
 - 1. VOC Content: E Range of E2.

2.6 Wood Primers

- A. Exterior Alkyd Wood Primer: MPI #5.
 - 1. VOC Content: E Range of E2.

- B. Exterior Oil Wood Primer: MPI #7.
 - 1. VOC Content: E Range of E2.

2.7 Exterior Alkyd Paints

- A. Exterior Alkyd Enamel (Semigloss): MPI #94 (Gloss Level 5).
 - 1. VOC Content: E Range of E2.

2.8 Quick-Drying Enamels

- A. Quick-Drying Enamel (Semigloss): MPI #81 (Gloss Level 5).
 - 1. VOC Content: E Range of E2.

2.9 Aluminum Paint

- A. Aluminum Paint: MPI #1.
 - 1. VOC Content: E Range of E2.

2.10 Floor Coatings

- A. Interior/Exterior Clear Concrete Floor Sealer (Solvent Based): MPI #104.
 - 1. VOC Content: E Range of E2.

Part 3 Execution

3.1 Examination

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry: 12 percent.
 - 3. Wood: 15 percent.
 - 4. Plaster: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

- D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 - 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 Preparation

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
 - 2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
- D. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.
- E. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- F. Aluminum Substrates: Remove surface oxidation.
- G. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- H. Plaster Substrates: Do not begin paint application until plaster is fully cured and dry.

3.3 Application

- A. Apply paints according to manufacturer's written instructions.
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 Field Quality Control

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:
 - 1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - 2. Testing agency will perform tests for compliance of paint materials with product requirements.
 - 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.5 Cleaning and Protection

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 Exterior Painting Schedule

A. Concrete Substrates, Nontraffic Surfaces:

1. Latex System:

- a. Prime Coat: Latex, exterior, matching topcoat.
- b. Intermediate Coat: Latex, exterior, matching topcoat.
- c. Topcoat: Latex, exterior semi-gloss (Gloss Level 5), MPI #11.

B. CMU Substrates:

1. Latex System:

- a. Prime Coat: Block filler, latex, interior/exterior, MPI #4.
- b. Intermediate Coat: Latex, exterior, matching topcoat.
- c. Topcoat: Latex, exterior semi-gloss (Gloss Level 5), MPI #11.

C. Steel Substrates:

1. Quick-Drying Enamel System:

- a. Prime Coat: Primer, alkyd, quick dry, for metal, MPI #76.
- b. Intermediate Coat: Alkyd, quick dry, matching topcoat.
- c. Topcoat: Alkyd, quick dry, semi-gloss (Gloss Level 5), MPI #81.

D. Galvanized-Metal Substrates:

1. Alkyd System:

- a. Prime Coat: Primer, galvanized metal, as recommended in writing by topcoat manufacturer for exterior use on galvanized-metal substrates with topcoat indicated.

- b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Alkyd, exterior, semi-gloss (Gloss Level 5), MPI #94.
- E. Aluminum Substrates:
- 1. Alkyd System:
 - a. Prime Coat: Primer, quick dry, for aluminum, MPI #95.
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Alkyd, exterior, semi-gloss (Gloss Level 5), MPI #94.
- F. Dressed Lumber Substrates: Including architectural woodwork.
- 1. Alkyd System:
 - a. Prime Coat: Primer, alkyd for exterior wood, MPI #5.
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Alkyd, exterior, semi-gloss (Gloss Level 5), MPI #94.

END OF SECTION

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 surface preparation and the application of paint systems on the following interior substrates:
 - 1. Concrete.
 - 2. Concrete masonry units (CMU).
 - 3. Steel.
 - 4. Galvanized metal.
 - 5. Aluminum (not anodized or otherwise coated).
 - 6. Wood.
 - 7. Gypsum board.
 - 8. Plaster.
- B. Related Sections include the following:
 - 1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
 - 2. Division 06 Sections for shop priming carpentry with primers specified in this Section.
 - 3. Division 09 painting Sections for special-use coatings.
 - 4. Division 09 Section "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.

1.3 Submittals

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of topcoat product indicated.

- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.
 - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.4 Quality Assurance

- A. MPI Standards:
 - 1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List".
 - 2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.
- B. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - b. Other Items: Architect will designate items or areas required.
 - 2. Apply benchmark samples after permanent lighting and other environmental services have been activated.
 - 3. Final approval of color selections will be based on benchmark samples.

- a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.5 Delivery, Storage, And Handling

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.6 Project Conditions

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints when 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.

1.7 Extra Materials

- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
 1. Quantity: Furnish an additional 1 gal. of each material and color applied.

Part 2 Products

2.1 Manufacturers

- 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:
 1. Benjamin Moore & Co.
 2. BLP Mobile Paint Manufacturing.
 3. ChemRex.
 4. Columbia Paint & Coatings.
 5. Coronado Paint.
 6. Davis Paint Company.

7. Duron, Inc.
8. ICI Paints.
9. Porter Paints.
10. PPG Architectural Finishes, Inc.
11. Sherwin-Williams Company (The).
12. Vista Paint.

2.2 Paint, General

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
2. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
3. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
4. Floor Coatings: VOC not more than 100 g/L.
5. Flat Topcoat Paints: VOC content of not more than 50 g/L.
6. Nonflat Topcoat Paints: VOC content of not more than 150 g/L.
7. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
8. Floor Coatings: VOC not more than 100 g/L.
9. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.

10. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.
- C. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
 2. Restricted Components: Paints and coatings shall not contain any of the following:
 - a. Acrolein.
 - b. Acrylonitrile.
 - c. Antimony.
 - d. Benzene.
 - e. Butyl benzyl phthalate.
 - f. Cadmium.
 - g. Di (2-ethylhexyl) phthalate.
 - h. Di-n-butyl phthalate.
 - i. Di-n-octyl phthalate.
 - j. 1,2-dichlorobenzene.
 - k. Diethyl phthalate.
 - l. Dimethyl phthalate.
 - m. Ethylbenzene.
 - n. Formaldehyde.
 - o. Hexavalent chromium.
 - p. Isophorone.
 - q. Lead.
 - r. Mercury.

- s. Methyl ethyl ketone.
- t. Methyl isobutyl ketone.
- u. Methylene chloride.
- v. Naphthalene.
- w. Toluene (methylbenzene).
- x. 1,1,1-trichloroethane.
- y. Vinyl chloride.

D. Colors: As selected by Architect from manufacturer's full range.

2.3 Block Fillers

A. Interior/Exterior Latex Block Filler: MPI #4.

- 1. VOC Content: E Range of E2.

2.4 Primers/Sealers

A. Interior Latex Primer/Sealer: MPI #50.

- 1. VOC Content: E Range of E2.
- 2. Environmental Performance Rating: EPR 2.

B. Interior Alkyd Primer/Sealer: MPI #45.

- 1. VOC Content: E Range of E2.

C. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.

2.5 Metal Primers

A. Alkyd Anticorrosive Metal Primer: MPI #79.

- 1. VOC Content: E Range of E2.

B. Cementitious Galvanized-Metal Primer: MPI #26.

- 1. VOC Content: E Range of E1.

C. Quick-Drying Primer for Aluminum: MPI #95.

- 1. VOC Content: E Range of E2.

2.6 Latex Paints

- A. Interior Latex (Semigloss): MPI #54 (Gloss Level 5).
 - 1. VOC Content: E Range of E2.
 - 2. Environmental Performance Rating: EPR 3.
- B. Institutional Low-Odor/VOC Latex (Semigloss): MPI #147 (Gloss Level 5).
 - 1. VOC Content: E Range of E3.
 - 2. Environmental Performance Rating: EPR 5.5.
- C. High-Performance Architectural Latex (Satin): MPI #140 (Gloss Level 4).
 - 1. VOC Content: E Range of E3.
 - 2. Environmental Performance Rating: EPR 6.5.

2.7 Alkyd Paints

- A. Interior Alkyd (Semigloss): MPI #47 (Gloss Level 5).
 - 1. VOC Content: E Range of E2.
 - 2. Environmental Performance Rating: EPR 2.
- B. Interior Alkyd (Gloss): MPI #48 (Gloss Level 6).
 - 1. VOC Content: E Range of E2.

Part 3 Execution

3.1 Examination

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry: 12 percent.
 - 3. Wood: 15 percent.

4. Gypsum Board: 12 percent.
 5. Plaster: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
 - D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 Preparation

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
 2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Concrete Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.
- G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

- H. Aluminum Substrates: Remove surface oxidation.
- I. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- J. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

3.3 Application

- A. Apply paints according to manufacturer's written instructions.
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:
 - 1. Mechanical Work:
 - a. Uninsulated metal piping.
 - b. Pipe hangers and supports.

- c. Tanks that do not have factory-applied final finishes.
 - d. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
 - e. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
2. Electrical Work:
- a. Electrical equipment that is indicated to have a factory-primed finish for field painting.

3.4 Field Quality Control

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:
- 1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - 2. Testing agency will perform tests for compliance with product requirements.
 - 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.5 Cleaning and Protection

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 Interior Painting Schedule

- A. Steel Substrates:
 - 1. High-Performance Architectural Latex System:
 - a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #79.
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural, semi-gloss (Gloss Level 5), MPI #141.
- B. Galvanized-Metal Substrates:
 - 1. High-Performance Architectural Latex System:
 - a. Prime Coat: Primer, galvanized, water based, MPI #134.
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural, semi-gloss (Gloss Level 5), MPI #141.
- C. Aluminum (Not Anodized or Otherwise Coated) Substrates:
 - 1. High-Performance Architectural Latex System:
 - a. Prime Coat: Primer, quick dry, for aluminum, MPI #95.
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural, semi-gloss (Gloss Level 5), MPI #141.
- D. Gypsum Board Substrates:
 - 1. Prime Coat: Primer sealer, latex, interior, MPI #50.
 - 2. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - 3. Topcoat: Latex, interior, high performance architectural, (Gloss Level 3), MPI #139.
- E. Concrete Substrates, Nontraffic Surfaces:

1. High-Performance Architectural Latex System:

- a. Prime Coat: Primer, alkali resistant, water based, MPI #3.
- b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
- c. Topcoat: Latex, interior, high performance architectural, (Gloss Level 3), MPI #139.

F. CMU Substrates:

1. High-Performance Architectural Latex System:

- a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
- b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
- c. Topcoat: Latex, interior, high performance architectural, (Gloss Level 3), MPI #139.

G. Wood Substrates:

1. High-Performance Architectural Latex System:

- a) Prime Coat: Primer, latex, for interior wood, MPI #39.
- c) Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
- e) Topcoat: Latex, interior, high performance architectural, semi-gloss (Gloss Level 5), MPI #141.

END OF SECTION

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. Cast dimensional characters.
 - 2. Cutout dimensional characters.
 - 3. Fabricated channel dimensional characters.
 - 4. Illuminated, fabricated channel dimensional characters.
 - 5. Molded-plastic dimensional characters.

1.3 Action Submittals

- A. Product Data: For each type of product.
- B. Shop Drawings: For signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
- C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
 - 1. Include representative Samples of available typestyles and graphic symbols.

1.4 Informational Submittals

- A. Qualification Data: For Installer and manufacturer
- B. Sample Warranty: For special warranty.

1.5 Closeout Submittals

- A. Maintenance Data: For signs to include in maintenance manuals.

1.6 Quality Assurance

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 Warranty

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

Part 2 Products

2.1 Performance Requirements

- A. Structural Performance: Signs and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.
 - 1. Uniform Wind Load: As indicated on Drawings
- B. Thermal Movements: For exterior fabricated channel dimensional characters, allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces

2.2 Dimensional Characters

- A. Cast Characters Insert drawing designation: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:
 - 1. Character Material: Cast aluminum
 - 2. Character Height: As per Florida Accessibility Code
 - 3. Thickness: Manufacturer's standard for size of character
 - 4. Finishes:
 - a. Integral Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities

5. Mounting: Concealed studs

2.3 Dimensional Character Materials

- A. Aluminum Castings: ASTM B 26/B 26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.
- B. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- C. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

2.4 Accessories

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
 1. Use concealed fasteners and anchors unless indicated to be exposed.

2.5 Fabrication

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
 4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 5. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.

6. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

2.6 General Finish Requirements

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.7 Aluminum Finishes

- A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.
- B. Color Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

Part 3 Execution

3.1 Examination

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Verify that electrical service is correctly sized and located to accommodate signs.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 - 3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Methods:
 - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

3.3 Adjusting and Cleaning

- A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

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. Phenolic-core toilet compartments configured as toilet enclosures.
- B. Related Requirements:
 - 1. Section 10 28 00 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories mounted on toilet compartments.

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 toilet compartments.
- B. Shop Drawings: For toilet compartments.
 - 1. Include plans, elevations, sections, details, and attachment details.
 - 2. Show locations of cutouts for compartment-mounted toilet accessories.
 - 3. Show locations of centerlines of toilet fixtures.
 - 4. Show locations of floor drains.
 - 5. Show ceiling-mounted items, and overhead support or bracing locations.
- C. Samples for Initial Selection: For each type of toilet compartment material indicated.
 - 1. Include Samples of hardware and accessories involving material and color selection.
- D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Each type of material, color, and finish required for toilet compartments, prepared on 6-inch- (152-mm-) square Samples of same thickness and material indicated for Work.
 2. Each type of hardware and accessory.
- E. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

1.4 Closeout Submittals

- A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.5 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. Door Hinges: One hinge with associated fasteners.
 2. Latch and Keeper: One latch and keeper with associated fasteners.
 3. Door Bumper: One door bumper with associated fasteners.
 4. Door Pull: One door pull with associated fasteners.
 5. Fasteners: Ten fasteners of each size and type.

1.6 Project Conditions

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

Part 2 Products

2.1 Performance Requirements

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing 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: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility

Guidelines for Buildings and Facilities and ICC A117.1 for toilet compartments designated as accessible.

2.2 Phenolic-Core Toilet Compartments

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
- a. Accurate Partitions Corp.; ASI Group
 - b. All American Metal Corp
 - c. American Sanitary Partition Corporation
 - d. Ampco Products, LLC
 - e. Bobrick Washroom Equipment, Inc.
 - f. Bradley Corporation
 - g. Decolam
 - h. Flush Metal Partition, LLC
 - i. General Partitions Mfg. Corp
 - j. Global Partitions; ASI Group
 - k. Knickerbocker Partition Corporation
 - l. Marlite
 - m. Metpar Corp
 - n. Scranton Products
 - o. Tex-Lam Manufacturing, Inc.
 - p. Weis-Robart Partitions, Inc
- B. Toilet-Enclosure Style: Floor and ceiling anchored.
- C. Door, Panel, and Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges and no-sightline system. Provide minimum 3/4-inch- (19-mm-) thick doors and pilasters and minimum 1/2-inch- (13-mm-) thick panels.

- D. Pilaster Shoes and Sleeves (Caps): Formed from stainless-steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.
- E. Brackets (Fittings):
 - 1. Stirrup Type: Ear or U-brackets, stainless steel.
 - 2. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.
- F. Phenolic-Panel Finish:
 - 1. Facing Sheet Finish: One color and pattern in each room.
 - 2. Color and Pattern: As selected by Architect from manufacturer's full range, with manufacturer's standard dark color core.
 - 3. Edge Color: Manufacturer's standard.

2.3 Hardware and Accessories

- A. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.
 - 1. Material: Stainless steel.
 - 2. Hinges: Manufacturer's standard continuous, spring-loaded type, allowing emergency access by lifting door.
 - 3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
 - 4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
 - 5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
 - 6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.
- B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

- C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless-steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 Materials

- A. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
- B. Stainless-Steel Castings: ASTM A 743/A 743M.

2.5 Fabrication

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- C. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- D. Floor-and-Ceiling-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at tops and bottoms of pilasters. Provide shoes and sleeves (caps) at pilasters to conceal anchorage.
- E. Door Size and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide in-swinging doors for standard toilet compartments and 36-inch- (914-mm-) wide out-swinging doors with a minimum 32-inch- (813-mm-) wide clear opening for compartments designated as accessible.

Part 3 Execution

3.1 Examination

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
 - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
1. Maximum Clearances:
 - a. Pilasters and Panels: 1/2 inch (13 mm).
 - b. Panels and Walls: 1 inch (25 mm).
 2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than two brackets attached or three brackets attached at midpoint and near top and bottom of panel.
 - a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
 3. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.
 - a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
- B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches (44 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.
- C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches (51 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.
- D. Floor-and-Ceiling-Anchored Units: Secure pilasters to supporting construction and level, plumb, and tighten. Hang doors and adjust so doors are level and aligned with panels when doors are in closed position.

3.3 Adjusting

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging

doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION

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. Public-use washroom accessories.
 - 2. Warm-air dryers.
 - 3. Childcare accessories.
 - 4. Underlavatory guards.
- B. Related Requirements:
 - 1. Section 08 83 00 "Mirrors" for frameless mirrors.
 - 2. Section 09 30 13 "Ceramic Tiling" for ceramic toilet and bath accessories.

1.3 Coordination

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

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.
 - 2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Include electrical characteristics.
- B. Samples: Full size, for each exposed product and for each finish specified.

1. Approved full-size Samples will be returned and may be used in the Work.
- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
1. Identify locations using room designations indicated.
 2. Identify accessories using designations indicated.

1.5 Informational Submittals

- A. Sample Warranty: For manufacturer's special warranty.

1.6 Closeout Submittals

- A. Maintenance Data: For accessories to include in maintenance manuals.

1.7 Warranty

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, visible silver spoilage defects.
 2. Warranty Period: 15 years from date of Substantial Completion.

Part 2 Products

2.1 Public-Use Washroom Accessories

- A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.
- B. 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.
- C. Toilet Tissue (Roll) Dispenser:
1. Description: Roll-in-reserve dispenser with hinged front secured with tumbler lockset
 2. Mounting: Surface mounted.
 3. Operation: Noncontrol delivery with standard spindle
 4. Capacity: Designed for 4-1/2- or 5-inch- (114- or 127-mm-) diameter tissue rolls.

5. Material and Finish: Stainless steel, No. 4 finish (satin)

D. Liquid-Soap Dispenser:

1. Description: Automatic dispenser with infrared sensor to detect presence of hands; battery powered; designed for dispensing antibacterial soap in liquid or lotion form.
2. Mounting: Vertically oriented, surface mounted.
3. Lockset: Tumbler type.
4. Refill Indicator: LED indicator.
5. Low Battery Indicator: LED indicator.

E. Grab Bar:

1. Mounting: Flanges with concealed fasteners.
2. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
 - a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
3. Outside Diameter: 1-1/2 inches (38 mm).
4. Configuration and Length: As indicated on Drawings

F. Sanitary-Napkin Disposal Unit:

1. Mounting: Surface mounted.
2. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
3. Receptacle: Removable.
4. Material and Finish: Stainless steel, No. 4 finish (satin)

G. Mirror Unit:

1. Frame: Stainless-steel angle, 0.05 inch (1.3 mm) thick
 - a. Corners: Manufacturer's standard
2. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.

- a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
 - b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
3. Size: As indicated on Drawings

H. Coat Hook:

1. Description: Double-prong unit.
2. Material and Finish: Stainless steel, No. 4 finish (satin)

2.2 Underlavatory Guards

A. Underlavatory Guard:

1. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
2. Material and Finish: Antimicrobial, molded plastic, white.

2.3 Warm-Air Dryers

- A. Source Limitations: Obtain warm-air dryers from single source from single manufacturer.
- B. Basis of Design: XLERATOR XL-SB-1.1N

2.4 Materials

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch (0.9-mm) minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.5 Fabrication

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

Part 3 Execution

3.1 Installation

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

3.2 Adjusting and Cleaning

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION

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. Fire-protection cabinets for the following:
 - a. Portable fire extinguishers.

1.3 Preinstallation Conference

- A. Preinstallation Conference: Conduct conference at Project site
 - 1. Review methods and procedures related to fire-protection cabinets including, but not limited to, the following:
 - a. Schedules and coordination requirements.

1.4 Action Submittals

- A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
 - 1. Show location of knockouts for hose valves.
- B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each type of exposed finish required.
- D. Samples for Initial Selection: For each type of exposed finish required.
- E. Samples for Verification: For each type of exposed finish required, prepared on Samples 6 by 6 inches (150 by 150 mm) square.
- F. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

1.5 Closeout Submittals

- A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.6 Coordination

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

1.7 Sequencing

- A. Apply decals or vinyl lettering on field-painted fire-protection cabinets after painting is complete.

Part 2 Products

2.1 Performance Requirements

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

2.2 Fire-Protection Cabinet

- A. Cabinet Type: Suitable for fire extinguisher
- B. Cabinet Construction: 1-hour fire rated in corridors, nonrated in other areas
 - 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch- (1.09-mm-) thick cold-rolled steel sheet lined with minimum 5/8-inch- (16-mm-) thick fire-barrier material. Provide factory-drilled mounting holes.
- C. Cabinet Material: Cold-rolled steel sheet, Aluminum sheet, or Stainless-steel sheet.
 - 1. Shelf: Same metal and finish as cabinet.
- D. Surface-Mounted Cabinet (in areas other than corridors): Cabinet box fully exposed and mounted directly on wall with no trim.
- E. Cabinet Trim Material: Same material and finish as door.
- F. Door Material: Cold-rolled steel sheet, Aluminum sheet, or Stainless-steel sheet
- G. Door Style: Center glass panel with frame
- H. Door Glazing: Tempered float glass (clear)

- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
- J. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 2. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
 - 3. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle
 - 4. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
 - 5. Alarm: Manufacturer's standard alarm that actuates when fire-protection cabinet door is opened and that is powered by batteries
- K. Materials:
 - 1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel or powder coat
 - b. Color: selected by Architect from full range of industry colors and color densities
 - 2. Aluminum: ASTM B 221 (ASTM B 221M), with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet. ASTM B 221 (ASTM B 221M) for extruded shapes.
 - a. Finish: Clear anodic
 - 3. Stainless Steel: ASTM A 666, Type 304.
 - a. Finish: No. 4 directional satin finish
 - 4. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear)

2.3 Fabrication

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 - 1. Weld joints and grind smooth.

2. Provide factory-drilled mounting holes.
 3. Prepare doors and frames to receive locks.
 4. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
 2. Fabricate door frames of one-piece construction with edges flanged.
 3. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 General Finish Requirements

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

Part 3 Execution

3.1 Examination

- A. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
1. Fire-Protection Cabinets: 54 inches (1372 mm) above finished floor to top of cabinet.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Provide inside latch and lock for break-glass panels.
 2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
 3. Fire-Rated Cabinets:
 - a. Install cabinet with not more than 1/16-inch (1.6-mm) tolerance between pipe OD and knockout OD. Center pipe within knockout.
 - b. Seal through penetrations with firestopping sealant as specified in Section 078413 "Penetration Firestopping."
- C. Identification: Apply decals or vinyl lettering at locations indicated.

3.3 Adjusting and Cleaning

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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 portable, fire extinguishers and mounting brackets for fire extinguishers.

1.3 Action Submittals

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

1.4 Informational Submittals

- A. Warranty: Sample of special warranty.

1.5 Closeout Submittals

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 Warranty

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

Part 2 Products

2.1 Performance Requirements

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 Portable, Hand-Carried Fire Extinguishers

- A. Fire Extinguishers: Type, size, and capacity for each mounting bracket indicated.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Amerex Corporation
 - b. Ansul Incorporated; Tyco International
 - c. Badger Fire Protection
 - d. Buckeye Fire Equipment Company
 - e. Fire End & Croker Corporation
 - f. Guardian Fire Equipment, Inc.
 - g. JL Industries, Inc.; a division of the Activar Construction Products Group
 - h. Kidde Residential and Commercial Division
 - i. Larsens Manufacturing Company
 - j. MOON American
 - k. Nystrom, Inc.
 - l. Pem All Fire Extinguisher Corp.; Pem Systems, Inc.
 - m. Potter Roemer LLC
 - n. Pyro-Chem; Tyco Fire Suppression & Building Products
 - o. Strike First Corporation of America (The)

2. Valves: Manufacturer's standard.
 3. Handles and Levers: Manufacturer's standard.
 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical Type in Steel Container: Under-sink in all break room areas in Police Station and Public Works Building. UL-rated 2-A:10-B:C, 5-lb (2.3-kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.3 Mounting Brackets

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or [red] [black] baked-enamel finish.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Amerex Corporation.
 - b. Ansul Incorporated; Tyco International.
 - c. Badger Fire Protection.
 - d. Buckeye Fire Equipment Company.
 - e. Fire End & Croker Corporation.
 - f. Guardian Fire Equipment, Inc.
 - g. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - h. Larsens Manufacturing Company.
 - i. Nystrom, Inc.
 - j. Potter Roemer LLC.
 - k. Strike First Corporation of America.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Vertical.

Part 3 Execution

3.1 Examination

- A. Examine fire extinguishers for proper charging and tagging.
 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION

Part 1 General

1.1 Scope

- A. This Section describes products to be incorporated into the water distribution system and requirements for the installation and use of these items. Furnish all products and perform all labor necessary to fulfill the requirements of these Specifications.
- B. It is the intent of these specifications to provide information supplemental to the contents of the construction drawings on the quality of materials, execution, measurement, etc. These specifications are general in nature and may contain products and requirements which are not applicable to the project. Discrepancies between these specifications and the construction drawings, either imagined or real, shall be brought to the attention of the County for clarification.

1.2 Description of Work

- A. Extent of work is shown on the drawings.
- B. Domestic water system work includes but is not limited to: Water mains, fire hydrants, valves, service connections and appurtenances.
- C. Comply with the requirements of applicable sections for excavation and backfilling required in connection with water distribution system work.
- D. Comply with requirements of Paragraph 2.13 of this section for concrete work required in connection with water distribution system work.
- E. Contractor is advised that existing water mains may be of various pipe materials, including asbestos cement. The Contractor shall be responsible for protection of existing water mains during construction and shall be responsible for repairing any pipes damaged during construction. Repair sections shall be PVC or ductile iron. The Contractor shall comply with all work site, air emission, solid waste and personal safety and protection regulations as related to the excavation, exposure, cutting, handling, containment and disposal of existing water main pipe material.
- F. The removal, encapsulation or enclosure, storage and disposal of pipe materials containing asbestos shall be in accordance with Sections 455.301 through 455.309 of the Florida State Statutes; American Water Works Association Manual of Water Supply Practices No. M16 "Work Practices for Asbestos – Cement Pipe"; 29 CFR 1910.19; 29 CFR 1926.1101, Appendix F; Asbestos NESHAP (40 CFR 61, Subpart M); 40 CFR 763, Appendix E; and all other industry and regulatory requirements.

1.3 Quality Assurance

- A. Codes and Standards: Perform all work in compliance with applicable requirements of governing authorities having jurisdiction and the applicable standards of the American Water Works Association (AWWA).
- B. Testing and Inspection Service
 - 1. Employ, at Contractor's expense, testing laboratory to perform bacteriological testing of water mains.
 - 2. It will be the responsibility of the Contractor to coordinate all testing, flushing, and inspections. The Contractor shall notify the County, testing service, and applicable agency inspectors 48 hours in advance of testing, flushing, and inspections.
 - 3. Hydrostatic test shall be completed by the Contractor in the presence of the County or County's representative.
- C. The manufacturer shall provide written certification to the County that all products furnished comply with all applicable requirements of these Specifications.

1.4 Submittals

- A. Prior to construction commencing, the Contractor shall submit for approval by the County manufacturer's certifications and cut sheets for the following items:
 - 1. Fire hydrant assemblies
 - 2. Valves
 - 3. Water main pipe
 - 4. Fittings
 - 5. Water services
 - 6. Water meters
 - 7. Tapping sleeves
 - 8. Air release valves
 - 9. Other appurtenances
- B. Qualifications: If requested by the County, submit evidence that manufacturers have consistently produced products of satisfactory quality and performance for a period of at least two years.

- C. Test Reports: Submit Bacteriological Test Reports directly to the County from the testing services with copy to Contractor.

1.5 Existing Utilities and Obstructions

- A. The Drawings indicate utilities or obstructions that are known to exist according to the best information available to the County. The Contractor shall call the Sunshine State One Call of Florida, Inc. (1-888-761-3042), as required by Florida Law and all utilities, agencies or departments that own and/or operate utilities in the vicinity of the construction work site, at least 72 hours (three business days) prior to construction, to verify the location of the existing utilities.
- B. Conflict with Existing Utilities
 - 1. Horizontal Conflict: Horizontal conflict shall be defined as when the actual horizontal separation between a utility, main, or service and the proposed water main does not permit safe installation of the water main by the use of sheeting, shoring, tie-back, supporting, or temporarily suspending service of the parallel or crossing facility. The Contractor may change the proposed alignment of the water main to avoid horizontal conflicts, if the new alignment remains within the available right-of-way or easement, complies with regulatory agency requirements, and after a written request to, and subsequent approval by the County. If, in the opinion of the County, the water main's proposed location cannot be adjusted, thus requiring the relocation of an existing utility, the County will direct the Contractor to relocate the utility as part of the Contract with the costs of such relocation being paid for as part of a change order.
 - 2. Vertical Conflict: Vertical conflict shall be defined as when the actual vertical separation between a utility, main, or service and the proposed water main does not permit the crossing without immediate or potential future damage to the utility, main, service, or the water main. The Contractor may change the proposed grade of the water main to avoid vertical conflicts if the changed grade maintains adequate cover and complies with regulatory agencies requirements after written request to and subsequent approval by the County. If, in the opinion of the County, the water main's proposed location cannot be adjusted, thus requiring the relocation of an existing utility, the County will direct the Contractor to relocate the utility as part of the Contract with the costs of such relocation being paid for as part of a change order.
- C. Electronic Locator: Have available at all times an electronic pipe locator and a magnetic locator, in good working order, to aid in locating existing pipe lines or other obstructions.
- D. Water Main Separation Requirements (See Utilities Standard Detail G-14)
 - 1. Water mains constructed in Bay County Rights-of-Way shall be laid to provide a minimum horizontal distance of at least three feet between the outside of the water main and the outside of any existing or proposed vacuum-type sanitary

sewer, storm sewer, storm water force main, or pipeline conveying reclaimed water. A horizontal distance of at least ten feet shall be provided between the outside of the water main and the outside of any existing or proposed gravity-type sanitary sewer, pressure-type sanitary sewer, wastewater force main, or pipeline conveying reclaimed water. A horizontal distance of at least ten feet shall be provided between the outside of the water main and all parts of any existing or proposed "on-site sewage treatment and disposal system". If ten feet cannot be maintained, refer to Florida Administrative Code 62-555.314, which states that a minimum of six feet is acceptable.

2. Water mains constructed in Bay County Right-of way, that will cross any existing or proposed gravity-type sanitary sewer, vacuum-type sanitary sewer, or storm sewer, will be laid so the outside of the water main is at least 6-inches above the other pipeline or at least 12-inches below the other pipeline. Water mains that will cross any existing or proposed pressure-type sanitary sewer, wastewater or storm water force main, or pipeline conveying reclaimed water will be laid so the outside of the water main is at least 12-inches above or below the other pipeline.
3. At the utility crossings described above, one full length of water main pipe will be centered above or below the other pipeline so the water main joints will be as far as possible from the other pipeline or the pipes will be arranged so that all water main joints are at least three feet from all joints in vacuum-type sanitary sewers, storm sewers, or storm water force mains, and at least six feet from all joints in gravity or pressure-type sanitary sewers, wastewater force mains, or pipelines conveying reclaimed water.

Part 2 Products

2.1 General

- A. All materials shall be new and unused. They shall be of standard, first grade quality and intended for the use for which they are offered. Materials or equipment which, in the opinion of the County, are inferior or of a lower grade than indicated, specified, or required will not be accepted.

2.2 Water Mains

- A. Ductile Iron Pipe (DIP)
 1. Ductile iron pipe shall be manufactured in accordance with AWWA C151. All pipes, except specials, shall be furnished in nominal lengths of 18 to 20 feet. Sizes will be as shown on the Drawings. All pipes shall be Pressure Class 250 and have corresponding minimum wall thickness, unless otherwise specified or shown on the Drawings.

2. Pipe and fittings shall be cement lined in accordance with AWWA C104. Pipe and fittings shall be furnished with an asphaltic outside coating per AWWA C151.
3. Fittings shall be ductile iron and shall conform to AWWA C110 or AWWA C153 with a minimum rated working pressure of 250 psi.
4. Joints: Unless shown or specified otherwise, joints shall be push-on or restrained joint type for pipe and standard mechanical, push-on or restrained joints for fittings. Push-on and mechanical joints shall conform to AWWA C111. Restrained joints shall be American "FLEX-RING" or "LOK-RING", or U.S. Pipe "TR FLEX" or "HP LOK". No field welding of restrained joint pipe will be permitted. Restraining gasket joints shall be assembled with American Fast-Grip gaskets or US Pipe FIELD LOK gasket.
5. Provide the appropriate gaskets for mechanical and flange joints. Gaskets for flange joints shall be made of 1/8-inch thick, cloth reinforced rubber; gaskets may be ring type or full face type. The gasket for a standard push-on or mechanical joint, shall be of BUNA-5, vulcanized styrene rubber (SBR) and in accordance with AWWA C111.
6. Bolts and Nuts
 - a. Provide the necessary bolts for connections. All bolts and nuts shall be threaded in accordance with ANSI B1.1, Coarse Thread Series, Class 2A external and 2B internal fit. All bolts and nuts shall be made in the U.S.A.
 - b. Bolts and nuts for mechanical joints shall be Tee Head Bolts and nuts of high strength low-alloy steel in accordance with ASTM A 242 to the dimensions shown in AWWA C111/ANSI A21.11.
 - c. Bolts for exposed service shall be zinc plated, cold pressed, steel machine bolts conforming to ASTM A 307, Grade B. Nuts for exposed service shall be zinc plated, heavy hex conforming to ASTM A 563. Zinc plating shall conform to ASTM B 633, Type II.
7. Mechanical joint glands shall be ductile iron.
8. Thrust collars and mid-span restraints shall be welded-on ductile iron body type designed to withstand thrust due to 250 psi internal pressure on a dead end.
9. Ductile iron pipe shall be encased in V-Bio polyethylene film where shown on the Drawings. V-Bio polyethylene film shall have a minimum thickness of 8 mils and shall meet the requirements of AWWA C105.
10. Acceptance will be on the basis of the County's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.

11. Ductile iron pipe exterior shall have continuous blue stripe if applied during manufacturing, the stripe is parallel that runs parallel to the axis of the pipe, that is located at no greater than 90 degree intervals around the circumference of the pipe, and that will remain intact during and after pipe installation. If tape or paint is used to stripe pipe during installation of the pipe, the tape or paint shall be applied in a continuous line that runs parallel to the axis of the pipe and that is located along the top of the pipe.

B. Polyvinyl Chloride (PVC) Pipe

1. Smaller than 4-inch Pipe: All PVC pipe and fittings less than 4-inches in diameter shall be manufactured in accordance with ASTM D2241, with a standard dimension ratio (DR) of 21, rated pressure 200 psi, and bear the National Sanitation Foundation Seal for potable water pipe.
2. 4-inch through 12-inch Pipe: PVC pipe shall be manufactured in accordance with AWWA C900, latest edition. Pipe shall be pressure class 235 and must meet dimension requirements of dimension ratio (DR) 18 and shall bear the National Sanitation Foundation seal for potable water pipe.
3. 14-inch and Larger Pipe: PVC pipe shall be manufactured in accordance with AWWA, C905, and latest edition. Pipe shall be pressure class 235 and must meet dimension requirements of dimension ratio (DR) 18 and shall bear the National Sanitation Foundation seal for potable water.
4. Joints: Joints shall be "push-on" and shall meet all requirements of ASTM D3139. Each bell shall be an integral wall section joint assembly using elastomeric gasket seals. All gaskets shall meet all requirements for performance as specified by ASTM F477.
5. Pipe Marking: All pipe shall be marked as prescribed in ASTM D2241 (e.g., nominal pipe size, type of plastic pipe material, pipe dimension ratio, pressure rating, ASTM specification designation number, manufacturer's name and code), and the National Sanitation Foundation Seal for potable water.
6. PVC Pipe for waterlines shall be blue.
7. Acceptance will be on the basis of the County's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards, including the National Sanitation Foundation. Additionally, each piece of pipe shall be stamped "NSF Approved".
8. Fusible PVC 4-inch through 24-inch shall be DIPS DR18 C900-C905.

- C. High Density Polyethylene Pipe (HDPE): All water main pipe sizes 4-inch through 24-inch shall be DIPS DR11 (200 psi).

2.3 Fittings (3-Inch and Larger)

- A. General: Fittings 3-inches and larger shall be ductile iron manufactured in accordance with ANSI/ AWWA C110/A21.10 or C153/A21.53. The minimum pressure rating for fittings shall be 250 psi.
- B. Coating: All fittings furnished with bituminous outside coating and shall be cement mortar lined and coated in accordance with AWWA C104.
- C. Anchoring Devices
 - 1. All anchoring devices shall be suitable for use with mechanical joint fittings meeting AWWA C110 and/or AWWA C111.
 - 2. All anchoring devices shall be constructed of ductile iron (at least ASTM A536 Grade 70-50-05) and manufactured in accordance with AWWA C110 and/or C111.
 - 3. All anchoring devices shall have a sufficient number of set screws so as to properly restrain various fittings or pipes at the rated pressure without the need for additional thrust restraint.
- D. Retainer Glands
 - 1. Mechanical joint restraint shall be incorporated in the design of the follower gland and shall include a restraining mechanism which, when actuated, imparts multiple wedging action against the pipe, increasing its resistance as the pressure increases. Glands shall be manufactured of ductile iron conforming to ASTM A536. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI A21.11 and ANSI/AWWA C153/A21.53, latest revision. Twist-off nuts shall be used to insure proper actuating of the restraining devices.
 - 2. Retainer glands for ductile iron pipe shall be MegaLug Series 1100, as manufactured by EBAA Iron, Uni-Flange Series 1400, as manufactured by Ford Meter Box Company, or Star Pipe Products Star-Grip Series 3000.
 - 3. Retainer glands for polyvinyl chloride pipe shall be MegaLug Series 2000 PV, as manufactured by EBAA Iron, Inc. or Star Pipe Products Stargrip Series 4000.
- E. Push-on Restraints
 - 1. Push-on joint restraints shall be Fast-Grip Gasket by American Ductile Iron Pipe Co., or equal.
 - 2. Bell harness restraints shall be MegaLug Series 2500 by EBAA Iron or equal.

2.4 Gate and Tapping Valves

- A. Resilient seat gate valves shall be located no more than 500 feet apart in commercial, industrial and high-density residential areas and no more than 1000 feet in all other areas. Valves shall be spaced to isolate a maximum of 40 single-family residential lots. A minimum of two valves per tee, and three valves per 4-way cross, shall be required to isolate and maintain adequate service. Valves shall be placed at branch lines and located at the end of all water main extensions except at looped cul-de-sacs.
- B. Smaller than 2-inches in Diameter: Gate valves shall be bronze, heavy duty, rising stem, wedge type with screwed or union bonnet. Valve ends shall be threaded type. Valves shall have a minimum 200 psi working pressure for water (125 psi working pressure for steam). Valves shall be made in the USA Gate valves shall be full port Crane No. 428 (threaded), Apollo Brass ball valve full port (threaded), or approved equal.
- C. 2-inches through 36-inches in Diameter: Gate valves shall be resilient seat wedge encapsulated with EPDM rubber type conforming to the requirements of AWWA C509 or AWWA C515 rated for 200 psi working pressure.
 - 1. Valves shall be provided with two Oring stem seals with one Oring located above and one Oring below the stem collar. The area between the Orings shall be filled with lubricant to provide lubrication to the thrust collar bearing surfaces each time the valve is operated. At least one antifriction washer shall be utilized to further minimize operating torque. All seals between valve parts, such as body and bonnet, bonnet and bonnet cover, shall be flat gaskets or Orings.
 - 2. The valve gate shall be made of cast or ductile iron having a vulcanized, synthetic rubber coating, or a seat ring attached to the disc with retaining screws. Sliding of the rubber on the seating surfaces to compress the rubber will not be allowed. The design shall be such that compression set of the rubber shall not affect the ability of the valve to seal when pressure is applied to either side of the gate. The sealing mechanism shall provide zero leakage at the water working pressure when installed with the line flow in either direction.
 - 3. All internal and exterior ferrous surfaces shall be coated with epoxy to a minimum thickness of 4 mils. The epoxy shall be nontoxic, impart no taste to the water and shall conform to AWWA C550.
 - 4. Stem nuts shall be independent of wedge and shall be of solid bronze conforming to ASTM B62.
 - 5. All valves shall open by turning a two-inch square operating nut counterclockwise.

6. Gate Valve: Joints shall be mechanical joints and shall conform to AWWA C111, and all bolts and nuts for mechanical joints shall be high-strength, low-alloy steel in accordance with AWWA C111. All gaskets shall be for a standard mechanical joint of BUNA-S (SBR Buna) in accordance with ANSI/AWWA C111/A21.4. All mechanical joint accessories shall be furnished with the valves.
7. All tapping valves shall have flange-by-mechanical joint ends.
8. All valves shall be furnished with operating nuts.
9. One operating wrench will be provided for each five valves furnished; at least one wrench shall be supplied.
10. All tapping valves shall be interchangeable with other makes of tapping sleeves.
11. For horizontal installation, all tapping valves 16-inch and larger must have bevel gearing and pipe plug on bottom of valve bottom side to install nipple and ball valve for flushing.
12. Approved models are:
 - a. American Flow Control Series 2500 Resilient Wedge Valve.
 - b. M & H C515
 - c. Mueller Company A-2362-78 Resilient Wedge Gate Valve with Aqua Grip.
 - d. AVK Resilient Seated Gate Valve Series 65, J & S Valves C515, or approved equal.
 - e. All tapping valves 16-inch and larger will be determined by the County on a cases by case basis for meeting operational requirements.

2.5 Butterfly Valves (3-Inch and Larger)

- A. Butterfly valves shall be resilient seated, short body design, and shall be designed, manufactured, and tested in accordance with all requirements of AWWA C504 for Class 150B.
- B. Valve bodies shall be ductile iron conforming to ASTM A-536, Grade 65-45-12 or ASTM A-126, Grade B cast iron. Shafts shall be ASTM A-276, Type 304 stainless steel, machined and polished. Valve discs shall be ductile iron, ASTM A-536, Grade 65-45-12 or ASTM A-126, Grade B cast iron. The valve shall have an EPDM seat.
- C. Valves shall be installed with the valve shafts horizontal. Valves and actuators shall have seals on all shafts and gaskets on valve actuator covers to prevent the entry of

water. Actuator mounting brackets shall be totally enclosed and shall have gasket seals.

D. Actuators

1. Valves shall be equipped with traveling nut, self-locking type actuators designed, manufactured and tested in accordance with AWWA C504. Actuators shall be capable of holding the disc in any position between full open and full closed without any movement or fluttering of the disc.
2. Actuators shall be furnished with fully adjustable mechanical stop-limiting devices. Actuators that utilize the sides of the actuator housing to limit disc travel are unacceptable.
3. Valve actuators shall be capable of withstanding a minimum of 450 foot pounds of input torque in either the open or closed position without damage.

E. Operators: Valves for buried service shall have a nut type operator and shall be equipped with a valve box and stem extension, as required.

F. Valve ends shall be mechanical joint type, except where flanged or restrained joint ends are shown. Flange joints shall meet the requirements of ANSI B16.1, Class 150.

G. Butterfly valves shall be manufactured by Mueller, M & H Valve, DeZurik, Val-Matic, or Pratt.

2.6 Tapping Sleeves

A. General: Tapping sleeves shall be full circle, constructed of stainless steel and in two halves. Tapping sleeve flange can be stainless steel or carbon steel.

B. Tapping Sleeves 3-inch or larger shall have a 3/4-inch threaded test port with a plug for pressure testing on the tapping sleeves & tap valves. All tapping sleeves 3-inch through 24-inch shall be Romac STS420 or JMC452, or approved equal. Any tapping sleeve 30-inch or larger will be reviewed on a case by case basis and requires approval from the County

C. The Contractor shall be responsible for determining the outside diameter of the pipe to be connected to prior to ordering the sleeve.

2.7 Tapping Saddles

A. General: Tapping saddles shall be constructed of heavy gray cast iron or ductile iron, with the attachment straps, nuts, and washers constructed of corrosion-resistant, alloy steel in accordance with AWWA C111. All tapping saddles shall be Smith Blair #317, JCM406, TPS T-3, or approved equal. Tapping saddles 3-inch and larger shall have a 3/4-inch threaded test port with plug for pressure testing on the tapping saddle and the tap valve.

2.8 Fire Hydrant

- A. All fire hydrants shall conform to the requirements of AWWA C502 for 150 psi working pressure. Hydrants shall be the compression type, closing with line pressure. The valve opening shall not be less than 5 ¼ -inches.
- B. In the event of a traffic accident, the hydrant barrel shall break away from the standpipe at a point above grade and in a manner which will prevent damage to the barrel and stem, preclude opening of the valve, and permit rapid and inexpensive restoration without digging or cutting off the water.
- C. The means for attaching the barrel to the standpipe shall permit facing the hydrant a minimum of eight different directions.
- D. Hydrants shall be fully bronze mounted with all working parts of bronze. Valve seat ring shall be bronze and shall screw into a bronze retainer.
- E. All working parts, including the seat ring shall be removable through the top without disturbing the barrel of the hydrant.
- F. The operating nut shall match those on the existing hydrants. The operating threads shall be totally enclosed in an operating chamber, separated from the hydrant barrel by a rubber O-ring stem seal and lubricated by a grease or an oil reservoir.
- G. Hydrant shall be a non-freezing design and be provided with a simple, positive, and automatic drain which shall be fully closed whenever the main valve is opened.
- H. Hose and pumper connections shall be breech-locked, pinned, or threaded and pinned to seal them into the hydrant barrel. Each hydrant shall have two 2½-inch hose connections and one 4½-inch pumper connection, all with National Standard threads and each equipped with cap and non-kinking chain.
- I. Hydrants shall be furnished with a mechanical joint connection to the spigot of the 6-inch hydrant lead.
- J. Minimum depth of bury shall be 3.5 feet. Provide extension section where necessary for proper vertical installation and in accordance with manufacturer's recommendations.
- K. All outside surfaces of the barrel above grade shall be painted with enamel equal to Koppers Glamortex 501 in color orange
- L. Hydrants shall be traffic model and shall be East Jordan 5CD250, American Flow Control B-84-B, M & H Valve 129, or approved equal.
- M. Placements of fire hydrants:
Residential area: Spacing shall be every 500 feet
Rural area: Spacing shall be every 1,000 feet, or determined on a case by case basis

2.9 Valve Boxes and Extension Stems

- A. Valve boxes shall be provided for all buried valves. Valve boxes shall be one complete assembled unit composed of the valve box and extension stem. All moving parts of the extension stem shall be enclosed in a housing to prevent contact with the soil. Valve box assembly shall be adjustable to accommodate variable trench depths.
- B. Covers shall have "WATER VALVE" or "WATER" cast into them. Valve boxes shall be manufactured in the United States.
- C. The stem assembly shall be of a telescoping design that allows for variable adjustment length. The material shall be galvanized square steel tubing. The stem assembly shall have a built-in device that prevents the stem assembly from disengaging at its fully extended length. The extension stem must be capable of surviving a torque test to 1000 ft-lb without failure. Valve box shall be equal to American's trench adapter.
- D. Valve box collars shall be poured in place concrete (see detail G-19).

2.10 Valve Markers

- A. The Contractor shall provide a Carsonite Utility Markers or approved equivalent with U.V. resistant decal for each valve installed. Valve decal shall be stamped "CAUTION WATER VALVE".

2.11 Hydrant Tees

- A. Hydrant tees shall be equal to ACIPCO A10180, SIP Industries, U.S. Pipe U-592, or approved equal.

2.12 12Anchor Couplings

- A. Lengths and sizes shall be as shown on the Drawings. Anchor couplings shall be equal to ACIPCO A-10895, SIP Industries, U.S. Pipe U-591, or approved equal.

2.13 Concrete

- A. Concrete shall have a compressive strength of not less than 3,000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. For job mixed concrete, submit the concrete mix design for approval by the County. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A-615, Grade 60. The thrust box shall not be poured over bolts or in such a way as to prevent bolt removal.

2.14 Detection Tape and Trace Wire

- A. Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tapes shall be color coded in accordance with APWA color codes with the following legends: Water Systems, Safety Precaution Blue, "Caution: Water Line Buried Below". Colors may be solid or striped. Tape shall be permanently printed with no surface printing allowed. Tape width shall be minimum 2-inches when buried less than 10-inches below the surface. Tape width shall be minimum 3-inches when buried greater than 10-inches and less than 20-inches. Detection tape shall be Pro-Line Safety Products Detectable Tape 2-inch No: 103111253 3-inch No: 103121253, or approved equal. In addition, the Contractor shall furnish and install 10 gauge coated copper tracing wire shall be Pro-Line HF-CCS-PE30 or Copperhead Superflex 1030, or approved equal.

2.15 Flushing Devices End Equipment

- A. Flushing Post Hydrants shall be M & H Style 33, Eclipse No. 2 Post Hydrant, or approved equal.
- B. Bacteriological Sampling Stations shall be Eclipse 88-SS, Gil Industry Sample Station, or approved equal.
- C. Automatic Auto Flushers shall be Kupferle Eclipse No. 9400, Mueller Hydro-Guard HG-1, or approved equal.

2.16 Water Services

- A. It is the intent of these Specifications that the water service connections shall duplicate those presently provided by the County in order to be compatible with their service maintenance procedures. All materials shall be NSF 61 "Approved".
- B. All materials installed under this Section shall have the approval of the NSF for water services.
- C. Residential Service:
 1. Contractor will install water service lines between the water main and existing right-of-way, terminating at the right-of-way with a curb stop. The service line curb stop and tracing wire must be stubbed out of the ground 3 feet and attached to a stake that will remain until water meters are installed. Water service separations between storm sewer and sanitary sewer shall be the same as for water mains.
 2. Tubing: Water service tubing shall be polyethylene Class 200, SDR9 manufactured in accordance with AWWA C902. All service tubing shall be 1-inch or larger.

3. Curb Stop shall be B43-342W-G-NL ball valve as manufactured by Ford Meter Box Company, Inc. or approved equal. Curb stop shall have wings for locking the valve in the closed position.
4. Corporation Stop shall be Ford F1000-G-NL, or approved equal.
5. Gate Valve: Gate valves shall be bronze, heavy duty, rising stem, wedge type with screwed or union bonnet. Valve ends shall be threaded or solder type as appropriate. Valves shall have a minimum 200 psi working pressure for water (125 psi working pressure for steam). Valves shall be made in the U.S.A. Gate valves shall be equal to Crane No. 428 (threaded) or Crane No. 1334 (solder end).
6. Fittings shall be manufactured of brass, cast with full port of full open valve and machined in accordance with AWWA C800.
7. Service Saddle shall be Smith Blair 317, JCM 406, or approved equal.
8. Meter Box:
 - a. Meter boxes shall be plastic or polymer concrete. Material shall meet or exceed the following:
 - b. Tensile Strength: 3,400 psi (ASTM D 638).
 - c. Flexural Modulus: 191,000 psi (ASTM D 790).
 - d. Impact Strength, Izod: 0.6 feet 16/inch (ASTM D 256).
 - e. Deflection Temperatures: 200 degrees F (ASTM D 648).
 - f. Plastic meter boxes shall be equal to Ametek, Plymouth Products Division or Brooks Products, Inc.
 - g. Traffic rated polymer concrete meter boxes for driveways, roads and sidewalks shall be equal to Glasmaster Tuff Box Series.
 - h. Meter box shall be fitted with a plastic solid cover.
 - i. Minimum dimensions shall be 10-3/4 x 16-inches top and 18-1/2 x 13-1/4-inches at bottom and 18-inches deep.
9. Water meters are not to be furnished; however, the water meter connection must be compatible with the water meters currently used by the County.
10. Backflow Preventers: Shall be furnished and installed by Contractor/Developer and be owned and maintained by Customer. Backflow preventer shall be Reduced Pressure Zone Type (RPZ).

- a. Backflow preventers shall be rated for operation with inlet water pressures up to 175 psig and water temperatures up to 140-1/2 degrees F. Backflow preventers shall be tested and certified in accordance with ASSE 1013 and AWWA C506 and C511.
 - b. Provide with bronze body construction, rubber check valve and relief valve assemblies, and Clecon check seats.
 - c. Provide bronze ball body valve test cocks.
 - d. Provide bronze body strainer on the inlet of each backflow preventer.
 - e. Acceptable Manufacturers: Watts Series 909, Wilkins, Hersey.
 - f. Residential dual check valve backflow preventers shall be Apollo dual check valve 4ALF-355-48 or approved equal. .
 - g. Refer to Bay County Cross Connection Control Program for more information on back flow prevention.
11. Trace wire shall be Number 10, coated Pro-Line HF-CCS-PE30, Copperhead Superflex 1030, or approved equal. Wire connectors shall be TL-LUG-SS, or approved equal.

D. Commercial Service:

1. A commercial service shall be constructed similar to a water main or residential service base on the size requirement. Regardless of size, a commercial service shall include a backflow preventer.
2. Provide isolation valves on the inlet and outlet of each backflow preventer for maintenance. These valves shall be quarter turn, full port, and resilient seated, bronze ball valves.

2.17 Check Valve Vaults, Meter Vaults 3-Inch and Larger, And Air Release Vaults

- A. All vault walls shall be made of precast concrete sections. The top and bottom sections shall also be precast unless shown otherwise or approved by the Engineer.
- B. All coarse aggregate shall be made from 100 percent calcareous rocks. The contractor shall furnish manufacturer's certificate stating the type of aggregate used in the manufacture of the valve vault.
- C. The materials shall conform to the following standards:
 1. Concrete shall be 4000 psi using ASTM C150 Type 2 cement.
 2. Wire mesh shall conform to ASTM A185.

3. Reinforcing rods shall be ASTM A615 grade 60.
- D. The top slab shall be cast with a locking access hatch in place. Access hatch shall be as specified on the drawings.
- E. Check valve and air release vaults can have one locking access hatch. Meter vaults 3-inch and larger must have a two piece locking access hatch. (Refer to W-9)

Part 3 Execution

3.1 Handling Pipe

- A. General: All material, unless otherwise directed, shall be unloaded at the job site and distributed at the site of the project by the Contractor. Materials shall be handled with care to avoid damage. In loading and unloading, pipe shall be lifted by hoists or slid or rolled on skids in such a manner as to avoid shock. Under no circumstances shall pipe be dropped. Pipe handled on skids must not be allowed to roll against pipe already on the ground. The Contractor shall be responsible for the safe handling of all materials. Damaged materials will be rejected by the County.
- B. Pipe shall be handled so as to avoid damage to the coating and lining. If, however, any part of the coating or lining is damaged by the Contractor, the repair shall be made by the Contractor at his expense in a manner satisfactory to the County before installation.
- C. Pipe shall be distributed on the site of the work parallel with and opposite or near the place it is to be laid in the trench, and with bell ends facing the directions in which the installation will proceed unless otherwise directed.
- D. Pipe shall be distributed and placed in such a manner that will not interfere with traffic.
- E. No pipe shall be strung further along the route than 1,000 feet beyond the area in which the Contractor is actually working without written permission from the County. The County reserves the right to reduce this distance to a maximum distance of 200 feet in residential and commercial areas based on the effects of the distribution to the adjacent property owners.
- F. No street or roadway may be closed for unloading of pipe without first obtaining permission from the proper authorities. The Contractor shall furnish and maintain proper warning signs and obstruction lights for the protection of traffic along highways, streets and roadways upon which pipe is distributed.
- G. No distributed pipe shall be placed inside drainage ditches.
- H. Distributed pipe shall be placed as far as possible from the roadway pavement, but no closer than five feet from the roadway pavement, as measured edge-to-edge.

3.2 Installation of Pipe

- A. General: Upon satisfactory installation of the pipe bedding, as specified in the "Earthwork for Utilities" section of these specifications, a continuous trough for the pipe barrel and recesses for the pipe joints shall be excavated by hand digging so that, when the pipe is laid in the trench true to line and grade, the pipe barrel will receive continuous, uniform support, and the joint will receive no pressure from the trench bottom.
- B. The interior of all pipe shall be thoroughly cleaned of all foreign material before being lowered into the trench and shall be kept clean during laying operations by means of plugs or other approved methods.
- C. All pipe, fittings, valves, and hydrants shall be carefully lowered into the trench, piece by piece, by means of hoisting apparatus, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to pipe, pipe coating, and pipe lining. Under no circumstances shall pipe or accessories be dropped, dumped or rolled into the trench from finished ground level.
- D. The gasket material for each joint shall be properly positioned before the pipe is lowered into the trench. The joining of the pipe shall proceed in accordance with the manufacturer's requirements.
- E. Watertight plugs shall be installed in the open ends of the pipe at all times when pipe laying is not in progress. At no time shall trench water be permitted to enter pipe.
- F. Cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe. Wherever it is necessary to cut gray or ductile cast iron pipe which is equipped with a push-on joint type bell end, the cut end of the pipe shall be adequately beveled so as to prevent the edge of the cut pipe from cutting or tearing the gasket as the plain end is inserted into the bell of the adjoining pipe or fitting. All field-cut pipe shall be beveled by the Contractor, and the pipe "short" shall be used as part of the pipeline construction.
- G. Whenever necessary to deflect pipe after proper homing from a straight line, either in the vertical or horizontal plane to avoid obstructions, the maximum allowable deflection shall be in accordance with the following:
- | <u>Push-on Joint Pipe</u> | <u>Maximum Deflection</u> |
|---------------------------|------------------------------|
| Size | |
| 4-inch thru 12-inch | $\frac{3}{4}$ -inch per foot |
| 16-inch thru 36-inch | $\frac{1}{2}$ -inch per foot |
- Only after the pipe has been properly homed will it be allowed to deflect.
- H. No pipe shall be laid in water or when the trench conditions or the weather is unsuitable for such work.
- I. All water lines and services shall be located a minimum of 36-inches below grade unless noted otherwise on the drawings.

- J. Any pipe which is disturbed or found to be defective after laying shall be removed and re-laid or replaced.
- K. Prior to connecting new work to existing lines or appurtenances, the Contractor shall verify location and elevation of existing connection point and notify County of any conflicts or discrepancies.
- L. Joints:
1. Before laying the pipe, all lumps, blisters, and excess asphaltic coating shall be removed from the bell and plain ends of each length of pipe. The pipe ends shall then be wire brushed and wiped until clean and dry. Where mechanical joints or push-on joints are specified, oil and grease also shall be removed. Pipe ends shall be kept clean until joints are made. The plain end of pipe for mechanical joints shall be lubricated with an approved pipe lubricant before installing the gaskets.
 2. In making up the push-on type joint, the gasket shall be placed in the socket per manufacturer's recommendation. A thin film of lubricant (approved by the pipe manufacturer) shall then be applied to the inside surface of the gasket that will come in contact with the entering pipe. The plain end of the pipe to be entered shall be thoroughly cleaned and placed in alignment with the bell of the pipe to which it is to be joined. The joint shall be made by exerting sufficient force on the entering pipe so that the plain end is moved past the gasket until it seats as per manufacturer's recommendation.
 - a. Pipe lubricant shall be JTM Ease-on Pipe Joint Lubricant and meet NSF/ANSI standard 61, or equal.
 - b. Shall be brushed over the gasket and the plain end of the pipe for push on joints and mechanical joints, where needed.
 3. Backhoe buckets or excavation equipment are not to be applied directly to the pipe.
 4. Mechanical joints shall be assembled in accordance with AWWA Standards. Mechanical joints shall be centered in the bells. An approved pipe lubricant shall be brushed over the gasket just prior to installation. The gasket and gland shall be placed in position, the bolts inserted, and the nuts tightened by hand.
 5. The bolts shall be tightened on opposite sides of the pipes by means of a torque wrench in such a manner that the gland shall be brought up evenly into the joint. The following range of bolt torques shall be applied:

<u>Bolt Size (Inches)</u>	<u>Range of Torque</u>
¾ -inch Diameter	85 to 95 ft.-lbs.
1-inch Diameter	95 to 100 ft.-lbs.
 6. If effective seal is not obtained at a maximum torque listed above, the joint shall be disassembled and reassembled after thorough cleaning.

7. If a joint is defective, it shall be cut out and entirely replaced or, if permission is given by the County, it may be repaired by a suitable clamp.
- M. **Expediting of Work:** Excavate, lay the pipe, and backfill as closely together as possible. Do not leave un-joined pipe in the trench overnight. Backfill and compact the trench as soon as possible after laying and jointing is completed. Cover the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress. If necessary to backfill over the end of an uncompleted pipe or accessory, close the end with a suitable plug, either push-on, mechanical joint, restrained joint or as approved by the County.
- N. **V-Bio Polyethylene Encasement:** Installation shall be in accordance with AWWA C105 and the manufacturer's instructions. All ends shall be securely closed with tape and all damaged areas shall be completely repaired to the satisfaction of the County. Installation shall be at locations shown on the Drawings.
- O. **Conflict with Existing Utilities**
1. **Horizontal Conflict:** Horizontal conflict shall be defined as when the actual horizontal separation between a utility, main, or service and the proposed water main does not permit safe installation of the water main by the use of sheeting, shoring, supporting, or temporarily suspending service of the parallel or crossing facility. The Contractor may change the proposed alignment of the water main to avoid horizontal conflicts if the new alignment remains within the available right-of-way or easement, complies with regulatory agency requirements and after a written request to and subsequent approval by the County. If, in the opinion of the County, the water main's proposed location cannot be adjusted, thus requiring the relocation of an existing utility, the County will direct the Contractor to relocate the utility as part of the Contract with the costs of such relocation being paid for as part of a change order. Separation of potable water, reclaimed water, storm and sewer systems shall comply with FDEP regulations and Standard Drawings.
 2. **Vertical Conflict:** Vertical conflict shall be defined as when the actual vertical separation between a utility, main, or service and the proposed water main does not permit the crossing without immediate or potential future damage to the utility, main, service, or the water main. The Contractor may change the proposed grade of the water main to avoid vertical conflicts if the changed grade maintains adequate cover and complies with regulatory agencies requirements after written request to and subsequent approval by the County. If, in the opinion of the County, the water main's proposed location cannot be adjusted, thus requiring the relocation of an existing utility, the County will direct the Contractor to relocate the utility as part of the Contract with the costs of such relocation being paid for as part of a change order. Separation of potable water, reclaimed water, storm and sewer systems shall comply with FDEP regulations and STANDARD DRAWINGS.
- P. **Electronic Locator:** Have available at all times an electronic pipe locator and a magnetic locator, in good working order, to aid in locating existing pipe lines or other obstructions.

Q. Water Main Separation Requirements (See Utilities Standard Detail G-14)

1. Water mains constructed in Bay County Rights-of-way shall be laid to provide a minimum horizontal distance of at least three feet between the outside of the water main and the outside of any existing or proposed vacuum-type sanitary sewer, storm sewer, storm water force main, or pipeline conveying reclaimed water. A horizontal distance of at least 10 feet shall be provided between the outside of the water main and the outside of any existing or proposed gravity-type sanitary sewer, pressure-type sanitary sewer, wastewater force main, or pipeline conveying reclaimed water. A horizontal distance of at least ten feet shall be provided between the outside of the water main and all parts of any existing or proposed "on-site sewage treatment and disposal system."
2. Water mains constructed in Bay county Right-of way, that will cross any existing or proposed gravity- or vacuum-type sanitary sewer or storm sewer will be laid so the outside of the water main is at least six inches above the other pipeline or at least 12-inches below the other pipeline. Water mains that will cross any existing or proposed pressure-type sanitary sewer, wastewater or storm water force main, or pipeline conveying reclaimed water will be laid so the outside of the water main is at least 12-inches above or below the other pipeline.
3. At the utility crossings described above, one full length of water main pipe will be centered above or below the other pipeline so the water main joints will be as far as possible from the other pipeline or the pipes will be arranged so that all water main joints are at least three feet from all joints in vacuum-type sanitary sewers, storm sewers, or storm water force mains, and at least six feet from all joints in gravity or pressure-type sanitary sewers, wastewater force mains, or pipelines conveying reclaimed water.

3.3 Installation of Fittings, Valves and Taps

- A. Fittings shall be handled with care to avoid damage. All fittings shall be loaded and unloaded by lifting, and under no circumstances shall fittings be dropped, skidded, or rolled. Under no circumstances shall fittings be placed against pipe or other fittings in such a manner that damage could result. Slings, hooks, or tongs used for lifting shall be padded in such a manner as to prevent damage to exterior surface or interior lining of fittings. If any part of the fittings' coating or lining is damaged by the Contractor, the repair or replacement shall be made by the Contractor at his expense and in a manner satisfactory to the County before installing. Fittings shall also be stored at all times in a safe manner to prevent damage and kept free of dirt, mud, or other foreign matter. All fitting gaskets shall be stored and placed in a cool location out of direct sunlight and out of contact with petroleum products. All gaskets shall be used on a first-in, first-out basis.
- B. Fittings shall be set and joined to the pipe in a manner specified previously for joint assembly. When conditions warrant, fittings should be provided with special support trussing and blocking. Buried valves that are 12-inches and larger valves shall be provided with special support, such as treated timbers, crushed stone, concrete

pads or a sufficiently tamped trench bottom so that the pipe will not be required to support the weight of the valve. Valves shall be installed in the closed position.

- C. Prior to installation, valves shall be inspected for direction of opening, number of turns to open, freedom of operation, tightness of pressure-containing bolting and test plugs, cleanliness of valve ports and especially seating surfaces, handling damage and cracks. Defective valves shall be corrected or held for inspection by the County. Valves shall be closed before being installed.
- D. A valve box shall be provided on each underground valve. They shall be carefully set, centered exactly over the operating nut and truly plumbed. The valve box shall not transmit shock or stress to the valve. The bottom flange of the lower belled portion of the box shall be placed below the valve operating nut. This flange shall be set on brick, so arranged that the weight of the valve box and superimposed loads will bear on the base and not on the valve or pipe. Extension stems shall be installed where depth of bury places the operating nut in excess of 60-inches beneath finished grade so as to set the top of the operating nut 30-inches below finished grade. The valve box cover shall be flush with the surface of the finished area or such other level as directed by the County.
- E. All valve boxes set in non-paved areas shall have concrete pads poured around the top section of the valve box. The pad shall be a 24-inch square and shall be centered on the valve box. All water valve covers shall be painted safety blue as prescribed by the American Public Works Association (APWA) uniform color code for utility systems. All valve covers shall be cast with the word WATER. A 2-inch monument shall be set on the North East corner of each 24-inch poured square pad of the valve box indicating the valve size, type, and number of turns required.
- F. In no case shall valves be used to bring misaligned pipe into alignment during installation. Pipe shall be supported in such a manner as to prevent stress on the valve.
- G. A valve marker shall be provided for each underground valve. Unless otherwise detailed on the Drawings or directed by the County, valve markers shall be installed 6 inches inside the right of way or easement. Raised pavement markers (RPM's) shall be provided and installed along the appropriate roadway centerline for each in-line valve on County owned right-of-way. RPM's for in-line valves shall be Type I, two-way, and white in color.
- H. Blow-Offs: Blow-offs shall not be connected to any sewer or submerged in any stream or be installed in any other manner that will permit back-siphoning of contaminated water.
- I. The valve and valve box shall be installed so water department personnel can insert a valve key through the valve box and completely open and close the valve.

3.4 Connections to Water Mains

- A. Make connections to existing pipe lines with tapping sleeves and valves, unless specifically shown otherwise on the Drawings.
- B. Location: Before laying pipe, locate the points of connection to existing water mains and uncover as necessary for the County to confirm the nature of the connection to be made.
- C. Interruption of Services: Make connections to existing water mains only when system operations permit. Operate existing valves only with the specific authorization and direct supervision of the County.
- D. Testing: The County must be present for the pressure test of the tapping saddle and tapping valve before the tap is allowed. Test shall be done through the saddle and the test machine or the saddle and tap valve.
- E. Tapping Saddles and Tapping Sleeves
 1. Holes in the new pipe shall be machine cut, either in the field or at the factory. No torch cutting of holes shall be permitted. The coupon shall be delivered to the County.
 2. Prior to attaching the saddle or sleeve, the pipe shall be thoroughly cleaned, utilizing a brush and rag, as required.
 3. Before performing field machine cut, the water tightness of the saddle or sleeve assembly shall be pressure tested. The interior of the assembly shall be filled with water. Then using a hydro-static hand pump, pump to a pressure of 150 psi to insure all air is expelled. No leakage shall be permitted for a period of thirty minutes.
 4. After attaching the saddle or sleeve to an existing main, but prior to making the tap, the interior of the assembly shall be disinfected. All surfaces to be exposed to potable water shall be swabbed or sprayed with a one percent hypochlorite solution.
- F. Connections and Repairs: Where connections or repairs are required, Contractor shall only use solid sleeves and provide all materials and labor necessary to make the connection or repair to the existing pipeline, excluding service lines 2-inch or smaller.

3.5 Installation of Fire Hydrants (See Utilities Standard Detail W-2)

- A. Prior to installation, inspect all hydrants for direction of opening, nozzle threading, operating nut and cap nut dimensions, tightness of pressure-containing bolting, cleanliness of inlet elbow, handling damage and cracks. Defective hydrants shall be corrected or held for inspection by the County.

- B. All hydrants shall stand plumb and shall have their nozzles parallel with or at right angles to the roadway, with pumper nozzle facing the roadway, except that hydrants having two-hose nozzles 90 degrees apart shall be set with each nozzle facing the roadway at an angle of 45 degrees.
- C. Hydrants shall be set to the established grade, with the centerline of the lowest nozzle at least 12-inches above the ground or as directed by the County.
- D. Each hydrant shall be connected to the main with a 6-inch branch controlled by an independent 6-inch valve located adjacent to the main. When a hydrant is set in soil that is pervious, drainage shall be provided at the base of the hydrant by first wrapping the weep hole/drain hole with a felt/mesh material that will allow the hydrant to drain. Then place coarse gravel or crushed stone mixed with coarse sand from the bottom of the trench to at least 6-inches above the drain port opening in the hydrant to a distance of 12-inches around the elbow.
- E. When a hydrant is set in clay or other impervious soil, a drainage pit 2 x 2 x 2 feet shall be excavated below each hydrant and filled with coarse gravel or crushed stone mixed with coarse sand under and around the elbow of the hydrant and to a level of 6-inches above the drain port.
- F. Hydrants shall be located as shown on the Drawings or as directed by the County. In the case of hydrants that are intended to fail at the ground-line joint upon vehicle impact, specific care must be taken to provide adequate soil resistance to avoid transmitting shock moment to the lower barrel and inlet connection. In loose or poor load bearing soil, this may be accomplished by pouring a concrete collar approximately 6-inches thick to a diameter of 24-inches at or near the ground line around the hydrant barrel.
- G. Raised pavement markers (RPM's) shall be provided and installed along the appropriate roadway centerline for each fire hydrant on County owned right-of-way. RPM's for inline valves shall be Type I, two-way, and blue in color.

3.6 Thrust Restraint

- A. Retainer Glands: Provide retainer glands at all points where hydraulic thrust may develop and on fire hydrants and all associated fittings, valves and related piping. Retainer glands shall be installed in accordance with the manufacturer's recommendations, particularly; the required torque of the set screws. The Contractor shall furnish a torque wrench to verify the torque on all set screws which do not have inherent torque indicators.
- B. Thrust Collars: Concrete collars shall be constructed as shown on the Drawings. The welded-on collar shall be attached to the pipe by the pipe manufacturer. Filter fabric shall be installed between the thrust collar and the adjacent soil.
- C. Concrete Blocking:
 - 1. Provide concrete blocking for all bends, tees, valves, and other points where thrust may develop, except where other exclusive means of thrust restraint are

specifically shown on the Drawings. Filter fabric shall be installed between the concrete blocking and the adjacent soil.

2. Form and pour concrete blocking at fittings as shown on the Drawings and as directed by the County. Pour blocking against undisturbed earth. Increase dimensions when required by over excavation.
- D. Cement Slabs: All 12-inch and larger tap valves will be supported by a poured cement slab. Slab size and thickness to be determined on a case by case basis by engineer and the County.

3.7 Detection Tape and Trace Wire

- A. Provide detection tape and trace wire for all water mains.
- B. Detection tape shall be located 18-inches above the crown of the pipe.
- C. Trace wire shall not be wrapped around the pipe.
- D. Trace wire shall be laid parallel to the 12 o'clock position of the main with at least 6-inches of separation.
- E. Trace wire shall be looped into each valve box and pulled out a minimum of two feet from the top of the valve box.

3.8 Water Service Connections

- A. Water service connections shall be installed to the properties adjacent to the water transmission mains both to the same side of the roadway (Short Side Service) and to the opposite side of the roadway (Long Side Service) as directed by the County.
- B. Water service connections installed under roadway shall be pulled through a casing. Casings shall be installed through a bored hole approximately equal in diameter to the external diameter of the casing. Minimum cover under roadway shall be four feet. At other locations, minimum cover shall be two feet.
- C. Installation shall conform to the details for water service connections appearing schematically on the Drawings. Contractor shall provide any and all appurtenant work required to provide the intended water service connections.
- D. Transfer of Service: Immediately before connecting to the relocated or existing meter, all service lines shall be flushed to remove any foreign matter. Any special fittings required to reconnect the existing meter, to the new copper service line, or the existing private service line, shall be provided by the Contractor. To minimize out of service time, the Contractor shall determine the connections to be made and have all the required pipe and fittings on hand before shutting off the existing service. After completing the connection, the new corporation stop shall be opened and all visible leaks shall be repaired.

- E. Backflow preventers shall be provided on all water services. Please refer to Paragraph 2.16(C)10 for further backflow specifications.
- F. GPS coordinates shall be provided for each service connection and lateral.

3.9 Testing, Flushing and Inspection Requirements

- A. It will be the responsibility of the Contractor to coordinate all testing, flushing and inspections. The Contractor shall notify the County and applicable agency inspectors 48 hours in advance of testing, flushing and inspections.

3.10 Hydrostatic Test

- A. All sections of the water main subject to internal pressure shall be pressure tested in accordance with AWWA C600. A section of main will be considered ready for testing after completion of all thrust restraint and backfilling.
- B. All tests shall be in the presence of the County.
- C. Each segment of water main between main valves shall be tested individually.
- D. Test Preparation
 1. Flush sections thoroughly at flow velocities, greater than 2.5 feet per second, adequate to remove debris from pipe and valve seats.
 2. Fully operate valves and hydrants to clean out seats.
 3. Provide temporary blocking, bulkheads, flanges and plugs as necessary, to assure all new pipes, valves and appurtenances will be pressure tested.
 4. Before applying test pressure, air shall be completely expelled from the pipeline and all appurtenances. Insert corporation cocks at highpoints to expel air as main is filled with water as necessary to supplement automatic air valves. Corporation stops shall be constructed as detailed on the Drawings with a meter box.
 5. Fill pipeline slowly with water. Provide a suitable pump with an accurate water meter to pump the line to the specified pressure.
 6. The differential pressure across a valve or hydrant shall equal the maximum possible, but not exceed the rated working pressure. Where necessary, provide temporary backpressure to meet the differential pressure restrictions.
 7. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure.
- E. Test Pressure: Test the pipeline at 150 psi or 1.5 times the operating pressure, whichever is greater, measured at the lowest point for at least two hours. Maintain the test pressure within 5 psi of the specified test pressure for the test duration (at

least two hours). Should the pressure drop more than 5 psi at any time during the test period, the pressure shall be restored to the specified test pressure. Provide an accurate pressure gauge with graduation not greater than 5 psi.

F. Leakage

1. Leakage shall be defined as the sum of the quantity of water that must be pumped into the test section, to maintain pressure within 5 psi of the specified test pressure for the test duration. Leakage shall be the total cumulative amount measured on a water meter.
2. The County assumes no responsibility for leakage occurring through existing valves.

G. Test Results: No test section shall be accepted if the leakage exceeds the limits determined by the following formula:

$$L = \frac{SD \sqrt{P}}{133,200}$$

Where: L = allowable leakage, in gallons per hour
 S = length of pipe tested, in feet
 D = nominal diameter of the pipe, in inches
 P = average test pressure during the leakage test, in pounds per square inch (gauge)
 As determined under Section 4 of AWWA C600.

Allowable leakage at various pressures and pipe sizes is shown in the Table

below (from AWWA C600 – Table 4.A) for 1000' of Pipe: *

Avg. Average Pressure (PSI)	Pipe Diameter (inches)												
	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"	24"	30"	36"
250	0.32	0.43	0.64	0.85	1.07	1.28	1.50	1.71	1.92	2.14	2.56	3.21	3.85
225	0.30	0.41	0.61	0.81	1.01	1.22	1.42	1.62	1.82	2.03	2.43	3.04	3.65
200	0.29	0.38	0.57	0.76	0.96	1.15	1.34	1.53	1.72	1.91	2.29	2.87	3.44
175	0.27	0.36	0.54	0.72	0.89	1.07	1.25	1.43	1.61	1.79	2.15	2.68	3.22
150	0.25	0.33	0.50	0.66	0.83	0.99	1.16	1.32	1.49	1.66	1.99	2.48	2.98
125	0.23	0.30	0.45	0.60	0.76	0.91	1.06	1.21	1.36	1.51	1.81	2.27	2.72
100	0.20	0.27	0.41	0.54	0.68	0.81	0.95	1.08	1.22	1.35	1.62	2.03	2.43

*If the water main section being tested contains lengths of various pipe diameters, the allowable leakage shall be the sum of the computed leakage for each diameter. The leakage test shall be repeated until the test section is accepted. All visible leaks shall be repaired regardless of leakage test results.

H. Completion: After a pipeline section has been accepted, relieve test pressure. Record type, size and location of all outlets on record drawings.

- I. Re-Testing: Any alterations made to pipeline performed after initial testing shall be re-tested and passed again, regardless of initial test results.
- J. Notification: Bay County shall be notified 24-hours in advance prior to Contractor performing pressure and leakage testing.

3.11 Trace Wire Continuity Test

- A. Prior to acceptance of pressure pipe by the County, the Contractor shall demonstrate that the locator tracer wire functions properly. During the tracer wire testing, the Contractor shall also demonstrate that the wire is connected to all services at meter boxes, hydrants, backflow preventers, butterfly valves, wastewater plug valves, tapping valves, air release valves, and blow-off valves. The Contractor shall use one of several commercially available utility locating instruments to energize and trace the locator wire for continuity. Direct signal locate method shall directly apply the current from the transmitter to the tracer wire and the signal shall be detected and followed with a receiver. Submit to the County Inspector for approval the method and equipment to be used. Testing of the locator wire shall be done prior to or concurrent with the hydrostatic pressure test.

1. 12 Disinfecting Pipeline

- B. After successfully pressure testing each pipeline section, disinfect in accordance with AWWA C651 for the continuous-feed method and these Specifications.
- C. Specialty Contractor: Disinfection shall be performed by an approved specialty contractor. Before disinfection is performed, the Contractor shall submit a written procedure for approval before being permitted to proceed with the disinfection. This plan shall also include the steps to be taken for the neutralization of the chlorinated water.

D. Chlorination

1. Apply chlorine solution to achieve a concentration of at least 25 milligrams per liter free chlorine in new line. Retain chlorinated water for 24 hours.
2. Chlorine concentration shall be recorded at every outlet along the line at the beginning and end of the 24 hour period.
3. After 24 hours, all samples of water shall contain at least 10 milligrams per liter free chlorine. Re-chlorinate if required results are not obtained on all samples.

- E. Disposal of Chlorinated Water: Reduce chlorine residual of disinfection water to less than one milligram per liter if discharged directly to a body of water or to less than two milligrams per liter if discharged onto the ground prior to disposal. Treat water with sulfur dioxide or other reducing chemicals to neutralize chlorine residual. Flush all lines until residual is equal to existing system.

F. Bacteriological Testing

1. After final flushing and prior to DEP approval, and the water main being placed into service, the Contractor shall collect samples from the line and have tested for bacteriological quality in accordance with the rules of the Florida Department of Environmental Protection.
2. The Contractor shall give Bay County Utilities 48-hour written notice of the planned bacteriological testing to facilitate public notification, if required. A County representative must be present when bacteriological samples and free and total chlorine residual are taken. Immediately after samples are taken, the Contractor will be responsible for delivering the samples to the Laboratory for testing. The bacteriological samples shall be analyzed for both coliform and non-coliform growth. Testing shall be performed by a laboratory certified by the State of Florida and approved by the County.
3. All sampling and testing costs shall be paid for by the Contractor prior to final acceptance.
4. Re-chlorinate lines until required results are obtained.
5. All testing must follow FDEP 62-555.900 guidelines.

END OF SECTION

Part 1 General

1.1 Scope

- A. This Section describes products to be incorporated into the Reclaimed Water Mains and requirements for the installation and use of these items. Furnish all products and perform all labor necessary to fulfill the requirements of these Specifications.
- B. It is the intent of these specifications to provide information supplemental to the contents of the construction drawings on the quality of materials, execution, measurement, etc. These specifications are general in nature and may contain products and requirements which are not applicable to the project. Discrepancies between these specifications and the construction drawings, either imagined or real, shall be brought to the attention of the County for clarification.
- C. General: Supply all products and perform all work in accordance with applicable American Society for Testing and Material (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), or other recognized standards. Latest revisions of all standards are applicable.
- D. All Reclaimed lines and equipment shall be painted per FDEP, Pantone Purple 522-C using light stable colorants and marked "RECLAIMED".

1.2 Description of Work

- A. Extent of work is shown on the drawings.
- B. Reclaimed Water System work includes, but is not limited to, Reclaimed Water Mains, valves, service connections and appurtenances.
- C. Comply with the requirements of applicable sections for excavation and backfilling required in connection with reclaimed water system work.
- D. Comply with requirements of Paragraph 2.13 of this section for concrete work required in connection with reclaimed water system work.
- E. Contractor is advised that existing reclaimed water mains may be of various pipe materials, including asbestos cement. The Contractor shall be responsible for protection of existing reclaimed water mains during construction and shall be responsible for repairing any pipes damaged during construction. Repair sections shall be PVC or ductile iron. The Contractor shall comply with all work site, air emission, solid waste, and personal safety and protection regulations as related to the excavation, exposure, cutting, handling, containment and disposal of existing reclaimed water main pipe material.
- F. The removal, encapsulation or enclosure, storage and disposal of pipe materials containing asbestos shall be in accordance with Sections 455.301 through 455.309 of the Florida State Statutes; American Water Works Association Manual of Water

Supply Practices No. M16 "Work Practices for Asbestos – Cement Pipe"; 29 CFR 1910.19; 29 CFR 1926.1101, Appendix F; Asbestos NESHAP (40 CFR 61, Subpart M); 40 CFR 763, Appendix E; and all other industry and regulatory requirements.

1.3 Quality Assurance

- A. Codes and Standards: Perform all work in compliance with applicable requirements of governing authorities having jurisdiction and the applicable standards of the American Water Works Association (AWWA).
- B. Testing and Inspection Service
 - 1. Employ, at Contractor's expense, testing laboratory to perform bacteriological testing of reclaimed water mains.
 - 2. It will be the responsibility of the Contractor to coordinate all testing, flushing, and inspections. The Contractor shall notify the County, testing service, and applicable agency inspectors 48 hours in advance of testing, flushing, and inspections.
 - 3. Hydrostatic test shall be completed by the Contractor in the presence of the County or County's representative.
- C. The manufacturer shall provide written certification to the County that all products furnished comply with all applicable requirements of these Specifications.

1.4 Submittals

- A. Prior to construction commencing, the Contractor shall submit for approval by the County manufacturer's certifications and cut sheets for the following items:
 - 1. Reclaimed and Flushing Hydrant Assemblies (Purple in Color)
 - 2. Valves
 - 3. Reclaimed Water Main Pipe
 - 4. Fittings
 - 5. Reclaimed Water Services
 - 6. Reclaimed Water meters
 - 7. Tapping sleeves
 - 8. Air release valves
 - 9. Other appurtenances

- B. Qualifications: If requested by the County, submit evidence that manufacturers have consistently produced products of satisfactory quality and performance for a period of at least two years.
- C. Test Reports: Submit Bacteriological Test Reports directly to the County from the testing services with copy to Contractor.

1.5 Existing Utilities and Obstructions

- A. The Drawings indicate utilities or obstructions that are known to exist according to the best information available to the County. The Contractor shall call the Sunshine State One Call of Florida, Inc. (1-888-761-3042), as required by Florida Law and all utilities, agencies or departments that own and/or operate utilities in the vicinity of the construction work site, at least 72 hours (three business days) prior to construction, to verify the location of the existing utilities.
- B. Conflict with Existing Utilities
 - 1. Horizontal Conflict: Horizontal conflict shall be defined as when the actual horizontal separation between a utility, main, or service and the proposed reclaimed water main does not permit safe installation of the reclaimed water main by the use of sheeting, shoring, tie-back, supporting, or temporarily suspending service of the parallel or crossing facility. The Contractor may change the proposed alignment of the reclaimed water main to avoid horizontal conflicts, if the new alignment remains within the available right-of-way or easement, complies with regulatory agency requirements, and after a written request to, and subsequent approval by the County. If, in the opinion of the County, the reclaimed water main's proposed location cannot be adjusted, thus requiring the relocation of an existing utility, the County will direct the Contractor to relocate the utility as part of the Contract with the costs of such relocation being paid for as part of a change order.
 - 2. Vertical Conflict: Vertical conflict shall be defined as when the actual vertical separation between a utility, main, or service and the proposed reclaimed water main does not permit the crossing without immediate or potential future damage to the utility, main, service, or the reclaimed water main. The Contractor may change the proposed grade of the reclaimed water main to avoid vertical conflicts if the changed grade maintains adequate cover and complies with regulatory agencies requirements after written request to and subsequent approval by the County. If, in the opinion of the County, the reclaimed water main's proposed location cannot be adjusted, thus requiring the relocation of an existing utility, the County will direct the Contractor to relocate the utility as part of the Contract with the costs of such relocation being paid for as part of a change order.
- C. Electronic Locator: Have available at all times an electronic pipe locator and a magnetic locator, in good working order, to aid in locating existing pipe lines or other obstructions.

- D. Reclaimed Water Main Separation Requirements (See Utilities Standard Detail G-14)
1. Reclaimed Water mains constructed in Bay County Rights-of-Way shall be laid to provide a minimum horizontal distance of at least three feet between the outside of the reclaimed water main and the outside of any existing or proposed vacuum-type sanitary sewer, storm sewer, storm water force main, or pipeline conveying reclaimed water. A horizontal distance of at least ten feet shall be provided between the outside of the reclaimed water main and the outside of any existing or proposed gravity-type sanitary sewer, pressure-type sanitary sewer, wastewater force main, or pipeline conveying reclaimed water. A horizontal distance of at least ten feet shall be provided between the outside of the reclaimed water main and all parts of any existing or proposed "on-site sewage treatment and disposal system". If ten feet cannot be maintained, refer to Florida Administrative Code 62-555.314, which states that a minimum of six feet is acceptable.
 2. Reclaimed Water Mains constructed in Bay County Right-of way, that will cross any existing or proposed gravity-type sanitary sewer, vacuum-type sanitary sewer, or storm sewer, will be laid so the outside of the reclaimed water main is at least 6-inches above the other pipeline or at least 12-inches below the other pipeline. Reclaimed water Mains that will cross any existing or proposed pressure-type sanitary sewer, wastewater or storm water force main, or pipeline conveying reclaimed water will be laid so the outside of the reclaimed water main is at least 12-inches above or below the other pipeline.
 3. At the utility crossings described above, one full length of reclaimed water main pipe will be centered above or below the other pipeline so the reclaimed water main joints will be as far as possible from the other pipeline or the pipes will be arranged so that all reclaimed water main joints are at least 3 feet from all joints in vacuum-type sanitary sewers, storm sewers, or storm water force mains, and at least six feet from all joints in gravity or pressure-type sanitary sewers, wastewater force mains, or pipelines conveying reclaimed water.

Part 2 Products

2.1 General

- A. All materials shall be new and unused. They shall be of standard, first grade quality and intended for the use for which they are offered. Materials or equipment which, in the opinion of the County, are inferior or of a lower grade than indicated, specified, or required will not be accepted.

2.2 Reclaimed Water Mains

A. Ductile Iron Pipe (DIP)

1. Ductile iron pipe shall be manufactured in accordance with AWWA C151. All pipes, except specials, shall be furnished in nominal lengths of 18 to 20 feet.

Sizes will be as shown on the Drawings. All pipes shall be Pressure Class 250 and have corresponding minimum wall thickness, unless otherwise specified or shown on the Drawings.

2. Pipe and fittings shall be cement lined in accordance with AWWA C104. Pipe and fittings shall be furnished with an asphaltic outside coating per AWWA C151.
3. Fittings shall be ductile iron and shall conform to AWWA C110 or AWWA C153 with a minimum rated working pressure of 250 psi.
4. Joints: Unless shown or specified otherwise, joints shall be push-on or restrained joint type for pipe and standard mechanical, push-on or restrained joints for fittings. Push-on and mechanical joints shall conform to AWWA C111. Restrained joints shall be American "FLEX-RING" or "LOK-RING", or U.S. Pipe "TR FLEX" or "HP LOK". No field welding of restrained joint pipe will be permitted. Restraining gasket joints shall be assembled with American Fast-Grip gaskets or US Pipe FIELD LOK gasket.
5. Provide the appropriate gaskets for mechanical and flange joints. Gaskets for flange joints shall be made of 1/8-inch thick, cloth reinforced rubber; gaskets may be ring type or full face type. The gasket for a standard push-on or mechanical joint, shall be of BUNA-5, vulcanized styrene rubber (SBR) and in accordance with AWWA C111.
6. Bolts and Nuts
 - a. Provide the necessary bolts for connections. All bolts and nuts shall be threaded in accordance with ANSI B1.1, Coarse Thread Series, Class 2A external and 2B internal fit. All bolts and nuts shall be made in the U.S.A.
 - b. Bolts and nuts for mechanical joints shall be Tee Head Bolts and nuts of high strength low-alloy steel in accordance with ASTM A 242 to the dimensions shown in AWWA C111/ANSI A21.11.
 - c. Bolts for exposed service shall be zinc plated, cold pressed, steel machine bolts conforming to ASTM A 307, Grade B. Nuts for exposed service shall be zinc plated, heavy hex conforming to ASTM A 563. Zinc plating shall conform to ASTM B 633, Type II.
7. Mechanical joint glands shall be ductile iron.
8. Thrust collars and mid-span restraints shall be welded-on ductile iron body type designed to withstand thrust due to 250 psi internal pressure on a dead end.
9. Ductile iron pipe shall be encased in V-Bio polyethylene film where shown on the Drawings. V-Bio polyethylene film shall have a minimum thickness of 8 mils and shall meet the requirements of AWWA C105.

10. Acceptance will be on the basis of the County's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.
11. Ductile iron pipe exterior shall have continuous blue stripe if applied during manufacturing, the stripe is parallel that runs parallel to the axis of the pipe, that is located at no greater than 90 degree intervals around the circumference of the pipe, and that will remain intact during and after pipe installation. If tape or paint is used to stripe pipe during installation of the pipe, the tape or paint shall be applied in a continuous line that runs parallel to the axis of the pipe and that is located along the top of the pipe.

B. Polyvinyl Chloride (PVC) Pipe

1. Smaller than 4-inch Pipe: All PVC pipe and fittings less than 4-inches in diameter shall be manufactured in accordance with ASTM D2241, with a standard dimension ratio (DR) of 21, rated pressure 200 psi, and bear the National Sanitation Foundation Seal for reclaimed water pipe.
2. 4-inch through 12-inch Pipe: PVC pipe shall be manufactured in accordance with AWWA C900, latest edition. Pipe shall be pressure class 235 and must meet dimension requirements of dimension ratio (DR) 18 and shall bear the National Sanitation Foundation seal for reclaimed water pipe.
3. 14-inch and Larger Pipe: PVC pipe shall be manufactured in accordance with AWWA, C905, and latest edition. Pipe shall be pressure class 235 and must meet dimension requirements of dimension ratio (DR) 18 and shall bear the National Sanitation Foundation seal for reclaimed water.
4. Joints: Joints shall be "push-on" and shall meet all requirements of ASTM D3139. Each bell shall be an integral wall section joint assembly using elastomeric gasket seals. All gaskets shall meet all requirements for performance as specified by ASTM F477.
5. Pipe Marking: All pipe shall be marked as prescribed in ASTM D2241 (e.g., nominal pipe size, type of plastic pipe material, pipe dimension ratio, pressure rating, ASTM specification designation number, manufacturer's name and code), and the National Sanitation Foundation Seal for reclaimed water.
6. PVC Pipe for reclaimed water lines shall be Pantone Purple 522-C.
7. Acceptance will be on the basis of the County's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards, including the National Sanitation Foundation. Additionally, each piece of pipe shall be stamped "NSF Approved".
8. Fusible PVC 4-inch through 24-inch shall be DIPS DR18 C900-C905.

- C. High Density Polyethylene Pipe (HDPE): All reclaimed water main pipe sizes 4-inch through 24-inch shall be DIPS DR11 (200 psi).

2.3 Fittings (3-Inch and Larger)

- A. General: Fittings 3-inches and larger shall be ductile iron manufactured in accordance with ANSI/ AWWA C110/A21.10 or C153/A21.53. The minimum pressure rating for fittings shall be 250 psi.
- B. Coating: All fittings furnished with bituminous outside coating and shall be cement mortar lined and coated in accordance with AWWA C104.
- C. Anchoring Devices
 1. All anchoring devices shall be suitable for use with mechanical joint fittings meeting AWWA C110 and/or AWWA C111.
 2. All anchoring devices shall be constructed of ductile iron (at least ASTM A536 Grade 70-50-05) and manufactured in accordance with AWWA C110 and/or C111.
 3. All anchoring devices shall have a sufficient number of set screws so as to properly restrain various fittings or pipes at the rated pressure without the need for additional thrust restraint.
- D. Retainer Glands
 1. Mechanical joint restraint shall be incorporated in the design of the follower gland and shall include a restraining mechanism which, when actuated, imparts multiple wedging action against the pipe, increasing its resistance as the pressure increases. Glands shall be manufactured of ductile iron conforming to ASTM A536. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI A21.11 and ANSI/AWWA C153/A21.53, latest revision. Twist-off nuts shall be used to insure proper actuating of the restraining devices.
 2. Retainer glands for ductile iron pipe shall be Megalug Series 1100, as manufactured by EBAA Iron, Uni-Flange Series 1400, as manufactured by Ford Meter Box Company, or Star Pipe Products Star-Grip Series 3000.
 3. Retainer glands for polyvinyl chloride pipe shall be Megalug Series 2000 PV, as manufactured by EBAA Iron, Inc or Star Pipe Products Stargrip Series 4000.
- E. Push-on Restraints
 1. Push-on joint restraints shall be Fast-Grip Gasket by American Ductile Iron Pipe Co., or equal.

2. Bell harness restraints shall be Megalug Series 2500 by EBBA Iron or equal.

2.4 Gate Valves

- A. Resilient seat gate valves shall be located no more than 500 feet apart in commercial, industrial and high-density residential areas and no more than 1000 feet in all other areas. Valves shall be spaced to isolate a maximum of 40 single-family residential lots. A minimum of two valves per tee, and three valves per 4-way cross, shall be required to isolate and maintain adequate service. Valves shall be placed at branch lines and located at the end of all reclaimed water main extensions except at looped cul-de-sacs.
- B. Smaller than 2-inches in Diameter: Gate valves shall be bronze, heavy duty, rising stem, wedge type with screwed or union bonnet. Valve ends shall be threaded type. Valves shall have a minimum 200 psi working pressure for reclaimed water (125 psi working pressure for steam). Valves shall be made in the USA Gate valves shall be full port Crane No. 428 (threaded), Apollo Brass ball valve full port (threaded), or approved equal.
- C. 2-inches through 36-inches in Diameter: Gate valves shall be resilient seat wedge encapsulated with EPDM rubber type conforming to the requirements of AWWA C509 or AWWA C515 rated for 200 psi working pressure.
 1. Valves shall be provided with two O-ring stem seals with one O-ring located above and one O-ring below the stem collar. The area between the O-rings shall be filled with lubricant to provide lubrication to the thrust collar bearing surfaces each time the valve is operated. At least one anti-friction washer shall be utilized to further minimize operating torque. All seals between valve parts, such as body and bonnet, bonnet and bonnet cover, shall be flat gaskets or O-rings.
 2. The valve gate shall be made of cast or ductile iron having a vulcanized, synthetic rubber coating, or a seat ring attached to the disc with retaining screws. Sliding of the rubber on the seating surfaces to compress the rubber will not be allowed. The design shall be such that compression-set of the rubber shall not affect the ability of the valve to seal when pressure is applied to either side of the gate. The sealing mechanism shall provide zero leakage at the reclaimed water working pressure when installed with the line flow in either direction.
 3. All internal and exterior ferrous surfaces shall be coated with epoxy to a minimum thickness of 4 mils. The epoxy shall be non-toxic, impart no taste to the reclaimed water and shall conform to AWWA C550.
 4. Stem nuts shall be independent of wedge and shall be of solid bronze conforming to ASTM B62.
 5. All valves shall open by turning a two-inch square operating nut counterclockwise.

6. Gate Valve: Joints shall be mechanical joints and shall conform to AWWA C111, and all bolts and nuts for mechanical joints shall be high-strength, low-alloy steel in accordance with AWWA C111. All gaskets shall be for a standard mechanical joint of BUNA-S (SBR Buna) in accordance with ANSI/AWWA C111/A21.4. All mechanical joint accessories shall be furnished with the valves.
7. All tapping valves shall have flange-by-mechanical joint ends.
8. All valves shall be furnished with operating nuts.
9. One operating wrench will be provided for each five valves furnished; at least one wrench shall be supplied.
10. All tapping valves shall be interchangeable with other makes of tapping sleeves.
11. For horizontal installation, all tapping valves 16-inch and larger must have bevel gearing and pipe plug on bottom of valve bottom side to install nipple and ball valve for flushing.
12. Approved models are:
 - a. American Flow Control Series 2500 Resilient Wedge Valve.
 - b. M & H C515
 - c. Mueller Company A-2362-78 Resilient Wedge Gate Valve with Aqua Grip.
 - d. AVK Resilient Seated Gate Valve Series 65, J & S Valves C515, or approved equal.
 - e. All tapping valves 16-inch and larger will be determined by the County on a cases by case basis for meeting operational requirements.

2.5 Butterfly Valves (3-Inch and Larger)

- A. Butterfly valves shall be resilient seated, short body design, and shall be designed, manufactured, and tested in accordance with all requirements of AWWA C504 for Class 150B.
- B. Valve bodies shall be ductile iron conforming to ASTM A 536, Grade 65-45-12 or ASTM A 126, Grade B cast iron. Shafts shall be ASTM A 276, Type 304 stainless steel, machined and polished. Valve discs shall be ductile iron, ASTM A 536, Grade 65-45-12 or ASTM A 126, Grade B cast iron. The valve shall have an EPDM seat.
- C. Valves shall be installed with the valve shafts horizontal. Valves and actuators shall have seals on all shafts and gaskets on valve actuator covers to prevent the entry of

reclaimed water. Actuator mounting brackets shall be totally enclosed and shall have gasket seals.

D. Actuators

1. Valves shall be equipped with traveling nut, self-locking type actuators designed, manufactured and tested in accordance with AWWA C504. Actuators shall be capable of holding the disc in any position between full open and full closed without any movement or fluttering of the disc.
2. Actuators shall be furnished with fully adjustable mechanical stop-limiting devices. Actuators that utilize the sides of the actuator housing to limit disc travel are unacceptable.
3. Valve actuators shall be capable of withstanding a minimum of 450 foot pounds of input torque in either the open or closed position without damage.

E. Operators: Valves for buried service shall have a nut type operator and shall be equipped with a valve box and stem extension, as required.

F. Valve ends shall be mechanical joint type, except where flanged or restrained joint ends are shown. Flange joints shall meet the requirements of ANSI B16.1, Class 150.

G. Butterfly valves shall be manufactured by Mueller, M & H Valve, DeZurik, Val-Matic, or Pratt.

2.6 Tapping Sleeves

A. General: Tapping sleeves shall be full circle, constructed of stainless steel and in two halves. Tapping sleeve flange can be stainless steel or carbon steel.

B. Tapping Sleeves 3-inch or larger shall have a 3/4-inch threaded test port with a plug for pressure testing on the tapping sleeves & tap valves. All tapping sleeves 3-inch through 24-inch shall be Romac STS420 or JMC452, or approved equal. Any tapping sleeve 30-inch or larger will be reviewed on a case by case basis and requires approval from the County

C. The Contractor shall be responsible for determining the outside diameter of the pipe to be connected to prior to ordering the sleeve.

2.7 Tapping Saddles

A. General: Tapping saddles shall be constructed of heavy gray cast iron or ductile iron, with the attachment straps, nuts, and washers constructed of corrosion-resistant, alloy steel in accordance with AWWA C111. All tapping saddles shall be Smith Blair #317, JCM406, TPS T-3, or approved equal. Tapping saddles 3-inch and larger shall have a 3/4-inch threaded test port with plug for pressure testing on the tapping saddle and the tap valve.

2.8 Fire Hydrant

- A. All fire hydrants shall conform to the requirements of AWWA C502 for 150 psi working pressure. Hydrants shall be the compression type, closing with line pressure. The valve opening shall not be less than 5¼ -inches.
- B. In the event of a traffic accident, the hydrant barrel shall break away from the standpipe at a point above grade and in a manner which will prevent damage to the barrel and stem, preclude opening of the valve, and permit rapid and inexpensive restoration without digging or cutting off the reclaimed water.
- C. The means for attaching the barrel to the standpipe shall permit facing the hydrant a minimum of eight different directions.
- D. Hydrants shall be fully bronze mounted with all working parts of bronze. Valve seat ring shall be bronze and shall screw into a bronze retainer.
- E. All working parts, including the seat ring shall be removable through the top without disturbing the barrel of the hydrant.
- F. The operating nut shall match those on the existing hydrants. The operating threads shall be totally enclosed in an operating chamber, separated from the hydrant barrel by a rubber O-ring stem seal and lubricated by a grease or an oil reservoir.
- G. Hydrant shall be a non-freezing design and be provided with a simple, positive, and automatic drain which shall be fully closed whenever the main valve is opened.
- H. Hose and pumper connections shall be breech-locked, pinned, or threaded and pinned to seal them into the hydrant barrel. Each hydrant shall have two 2½-inch hose connections and one 4½-inch pumper connection, all with National Standard threads and each equipped with cap and non-kinking chain.
- I. Hydrants shall be furnished with a mechanical joint connection to the spigot of the 6-inch hydrant lead.
- J. Minimum depth of bury shall be 3½ feet. Provide extension section where necessary for proper vertical installation and in accordance with manufacturer's recommendations.
- K. All outside surfaces of the barrel above grade shall be painted with enamel equal to Koppers Glamortex 501 in color orange
- L. Hydrants shall be traffic model and shall be East Jordan 5CD250, American Flow Control B-84-B, M & H Valve 129, or approved equal.
- M. Placements of fire hydrants:
Residential area: Spacing shall be every 500 feet
Rural area: Spacing shall be every 1,000 feet, or determined on a case by case basis

2.9 Valve Boxes and Extension Stems

- A. Valve boxes shall be provided for all buried valves. Valve boxes shall be one complete assembled unit composed of the valve box and extension stem. All moving parts of the extension stem shall be enclosed in a housing to prevent contact with the soil. Valve box assembly shall be adjustable to accommodate variable trench depths.
- B. Covers shall have "RECLAIMED WATER VALVE" or "RECLAIMED WATER" cast into them. Valve boxes shall be manufactured in the United States.
- C. The stem assembly shall be of a telescoping design that allows for variable adjustment length. The material shall be galvanized square steel tubing. The stem assembly shall have a built-in device that prevents the stem assembly from disengaging at its fully extended length. The extension stem must be capable of surviving a torque test to 1000 ft-lb without failure. Valve box shall be equal to American's trench adapter.
- D. Valve box collars shall be poured in place concrete (see detail G-19).

2.10 Valve Markers

- A. The Contractor shall provide a Carsonite Utility Markers or approved equivalent with U.V. resistant decal for each valve installed. Valve decal shall be stamped "CAUTION RECLAIMED WATER VALVE".

2.11 Hydrant Tees

- A. Hydrant tees shall be equal to ACIPCO A10180, SIP Industries, U.S. Pipe U-592, or approved equal.

2.12 Anchor Couplings

- A. Lengths and sizes shall be as shown on the Drawings. Anchor couplings shall be equal to ACIPCO A 10895, SIP Industries, U.S. Pipe U-591, or approved equal.

2.13 Concrete

- A. Concrete shall have a compressive strength of not less than 3,000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. For job mixed concrete, submit the concrete mix design for approval by the County. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60. The thrust box shall not be poured over bolts or in such a way as to prevent bolt removal.

2.14 Detection Tape and Trace Wire

- A. Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tapes shall be color coded in accordance with APWA color codes with the following legends: Reclaimed Water Systems, Safety Precaution Purple, "Caution: Reclaimed Water Line Buried Below". Colors may be solid or striped. Tape shall be permanently printed with no surface printing allowed. Tape width shall be minimum 2-inches when buried less than 10-inches below the surface. Tape width shall be minimum 3-inches when buried greater than 10-inches and less than 20-inches. Detection tape shall be Pro-Line Safety Products Detectable Tape 2-inch No: 103111253 3-inch No: 103121253, or approved equal. In addition, the Contractor shall furnish and install 10 gauge coated copper tracing wire shall be Pro-Line HF-CCS-PE30 or Copperhead Superflex 1030, or approved equal.

2.15 Flushing Devices End Equipment

- A. Flushing Post Hydrants shall be M & H Style 33, Eclipse No. 2 Post Hydrant, or approved equal.
- B. Bacteriological Sampling Stations shall be Eclipse 88-SS, Gil Industry Sample Station, or approved equal.
- C. Automatic Auto Flushers shall be Kupferle Eclipse No. 9400, Mueller Hydro-Guard HG-1, or approved equal.

2.16 Reclaimed Water Services

- A. It is the intent of these Specifications that the reclaimed water service connections shall duplicate those presently provided by the County in order to be compatible with their service maintenance procedures. All materials shall be NSF 61 "Approved".
- B. All materials installed under this Section shall have the approval of the NSF for reclaimed water services.
- C. Residential Service:
 1. Contractor will install reclaimed water service lines between the reclaimed water main and existing right-of-way, terminating at the right-of-way with a curb stop. The service line curb stop and tracing wire must be stubbed out of the ground 3 feet and attached to a stake that will remain until reclaimed water meters are installed. Reclaimed water service separations between storm sewer and sanitary sewer shall be the same as for reclaimed water mains.
 2. Tubing: Reclaimed water service tubing shall be polyethylene Class 200, SDR9 manufactured in accordance with AWWA C902. All service tubing shall be 1-inch or larger.

3. Curb Stop shall be B43-342W-G-NL ball valve as manufactured by Ford Meter Box Company, Inc. or approved equal. Curb stop shall have wings for locking the valve in the closed position.
4. Corporation Stop shall be Ford F1000-G-NL, or approved equal.
5. Gate Valve: Gate valves shall be bronze, heavy duty, rising stem, wedge type with screwed or union bonnet. Valve ends shall be threaded or solder type as appropriate. Valves shall have a minimum 200 psi working pressure for reclaimed water (125 psi working pressure for steam). Valves shall be made in the U.S.A. Gate valves shall be equal to Crane No. 428 (threaded) or Crane No. 1334 (solder end).
6. Fittings shall be manufactured of brass, cast with full port of full open valve and machined in accordance with AWWA C800.
7. Service Saddle shall be Smith Blair 317, JCM 406, or approved equal.
8. Meter Box:
 - a. Meter boxes shall be plastic or polymer concrete. Material shall meet or exceed the following:
 - b. Tensile Strength: 3,400 psi (ASTM D 638).
 - c. Flexural Modulus: 191,000 psi (ASTM D 790).
 - d. Impact Strength, Izod: 0.6 feet 16/inch (ASTM D 256).
 - e. Deflection Temperatures: 200 degrees F (ASTM D 648).
 - f. Plastic meter boxes shall be equal to Ametek, Plymouth Products Division or Brooks Products, Inc.
 - g. Traffic rated polymer concrete meter boxes for driveways, roads and sidewalks shall be equal to Glasmaster Tuff Box Series.
 - h. Meter box shall be fitted with a plastic solid cover.
 - i. Minimum dimensions shall be 10-3/4 x 16-inches top and 18-1/2 x 13-1/4-inches at bottom and 18-inches deep.
9. Reclaimed Water meters are not to be furnished; however, the reclaimed water meter connection must be compatible with the reclaimed water meters currently used by the County.
10. Backflow Preventers: Shall be furnished and installed by Contractor/Developer and be owned and maintained by Customer. Backflow preventer shall be Reduced Pressure Zone Type (RPZ).

- a. Backflow preventers shall be rated for operation with inlet reclaimed water pressures up to 175 psig and reclaimed water temperatures up to 140-1/2 degrees F. Backflow preventers shall be tested and certified in accordance with ASSE 1013 and AWWA C506 and C511.
 - b. Provide with bronze body construction, rubber check valve and relief valve assemblies, and Clecon check seats.
 - c. Provide bronze ball body valve test cocks.
 - d. Provide bronze body strainer on the inlet of each backflow preventer.
 - e. Acceptable Manufacturers: Watts Series 909, Wilkins, Hersey.
 - f. Residential dual check valve backflow preventers shall be Apollo dual check valve 4ALF-355-48 or approved equal. .
 - g. Refer to Bay County Cross Connection Control Program for more information on back flow prevention.
11. Trace wire shall be Number 10, coated Pro-Line HF-CCS-PE30, Copperhead Superflex 1030, or approved equal. Wire connectors shall be TL-LUG-SS, or approved equal.

D. Commercial Service:

1. A commercial service shall be constructed similar to a reclaimed water main or residential service base on the size requirement. Regardless of size, a commercial service shall include a backflow preventer.
2. Provide isolation valves on the inlet and outlet of each backflow preventer for maintenance. These valves shall be quarter turn, full port, and resilient seated, bronze ball valves.

2.17 Check Valve Vaults, Meter Vaults 3-Inch and Larger, And Air Release Vaults

- A. All vault walls shall be made of precast concrete sections. The top and bottom sections shall also be precast unless shown otherwise or approved by the Engineer.
- B. All coarse aggregate shall be made from 100 percent calcareous rocks. The contractor shall furnish manufacturer's certificate stating the type of aggregate used in the manufacture of the valve vault.
- C. The materials shall conform to the following standards:
 1. Concrete shall be 4000 psi using ASTM C150 Type 2 cement.
 2. Wire mesh shall conform to ASTM A185.

3. Reinforcing rods shall be ASTM A615 grade 60.
- D. The top slab shall be cast with a locking access hatch in place. Access hatch shall be as specified on the drawings.
- E. Check valve and air release vaults can have one locking access hatch. Meter vaults 3-inch and larger must have a two piece locking access hatch. (Refer to W-9)

Part 3 Execution

3.1 Handling Pipe

- A. General: All material, unless otherwise directed, shall be unloaded at the job site and distributed at the site of the project by the Contractor. Materials shall be handled with care to avoid damage. In loading and unloading, pipe shall be lifted by hoists or slid or rolled on skids in such a manner as to avoid shock. Under no circumstances shall pipe be dropped. Pipe handled on skids must not be allowed to roll against pipe already on the ground. The Contractor shall be responsible for the safe handling of all materials. Damaged materials will be rejected by the County.
- B. Pipe shall be handled so as to avoid damage to the coating and lining. If, however, any part of the coating or lining is damaged by the Contractor, the repair shall be made by the Contractor at his expense in a manner satisfactory to the County before installation.
- C. Pipe shall be distributed on the site of the work parallel with and opposite or near the place it is to be laid in the trench, and with bell ends facing the directions in which the installation will proceed unless otherwise directed.
- D. Pipe shall be distributed and placed in such a manner that will not interfere with traffic.
- E. No pipe shall be strung further along the route than 1,000 feet beyond the area in which the Contractor is actually working without written permission from the County. The County reserves the right to reduce this distance to a maximum distance of 200 feet in residential and commercial areas based on the effects of the distribution to the adjacent property owners.
- F. No street or roadway may be closed for unloading of pipe without first obtaining permission from the proper authorities. The Contractor shall furnish and maintain proper warning signs and obstruction lights for the protection of traffic along highways, streets and roadways upon which pipe is distributed.
- G. No distributed pipe shall be placed inside drainage ditches.
- H. Distributed pipe shall be placed as far as possible from the roadway pavement, but no closer than five feet from the roadway pavement, as measured edge-to-edge.

3.2 Installation of Pipe

- A. General: Upon satisfactory installation of the pipe bedding, as specified in the "Earthwork for Utilities" section of these specifications, a continuous trough for the pipe barrel and recesses for the pipe joints shall be excavated by hand digging so that, when the pipe is laid in the trench true to line and grade, the pipe barrel will receive continuous, uniform support, and the joint will receive no pressure from the trench bottom.
- B. The interior of all pipe shall be thoroughly cleaned of all foreign material before being lowered into the trench and shall be kept clean during laying operations by means of plugs or other approved methods.
- C. All pipe, fittings, valves, and hydrants shall be carefully lowered into the trench, piece by piece, by means of hoisting apparatus, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to pipe, pipe coating, and pipe lining. Under no circumstances shall pipe or accessories be dropped, dumped or rolled into the trench from finished ground level.
- D. The gasket material for each joint shall be properly positioned before the pipe is lowered into the trench. The joining of the pipe shall proceed in accordance with the manufacturer's requirements.
- E. Watertight plugs shall be installed in the open ends of the pipe at all times when pipe laying is not in progress. At no time shall trench reclaimed water be permitted to enter pipe.
- F. Cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe. Wherever it is necessary to cut gray or ductile cast iron pipe which is equipped with a push-on joint type bell end, the cut end of the pipe shall be adequately beveled so as to prevent the edge of the cut pipe from cutting or tearing the gasket as the plain end is inserted into the bell of the adjoining pipe or fitting. All field-cut pipe shall be beveled by the Contractor, and the pipe "short" shall be used as part of the pipeline construction.
- G. Whenever necessary to deflect pipe after proper homing from a straight line, either in the vertical or horizontal plane to avoid obstructions, the maximum allowable deflection shall be in accordance with the following:
- Push-on Joint Pipe
- | <u>Size</u> | <u>Maximum Deflection</u> |
|----------------------|------------------------------|
| 4-inch thru 12-inch | $\frac{3}{4}$ -inch per foot |
| 16-inch thru 36-inch | $\frac{1}{2}$ -inch per foot |
- Only after the pipe has been properly homed will it be allowed to deflect.
- H. No pipe shall be laid in reclaimed water or when the trench conditions or the weather is unsuitable for such work.
- I. All reclaimed water lines and services shall be located a minimum of 36-inches below grade unless noted otherwise on the drawings.

- J. Any pipe which is disturbed or found to be defective after laying shall be removed and re-laid or replaced.
- K. Prior to connecting new work to existing lines or appurtenances, the Contractor shall verify location and elevation of existing connection point and notify County of any conflicts or discrepancies.
- L. Joints:
1. Before laying the pipe, all lumps, blisters, and excess asphaltic coating shall be removed from the bell and plain ends of each length of pipe. The pipe ends shall then be wire brushed and wiped until clean and dry. Where mechanical joints or push-on joints are specified, oil and grease also shall be removed. Pipe ends shall be kept clean until joints are made. The plain end of pipe for mechanical joints shall be lubricated with an approved pipe lubricant before installing the gaskets.
 2. In making up the push-on type joint, the gasket shall be placed in the socket per manufacturer's recommendation. A thin film of lubricant (approved by the pipe manufacturer) shall then be applied to the inside surface of the gasket that will come in contact with the entering pipe. The plain end of the pipe to be entered shall be thoroughly cleaned and placed in alignment with the bell of the pipe to which it is to be joined. The joint shall be made by exerting sufficient force on the entering pipe so that the plain end is moved past the gasket until it seats as per manufacturer's recommendation.
 - a. Pipe lubricant shall be JTM Ease-on Pipe Joint Lubricant and meet NSF/ANSI standard 61, or equal.
 - b. Shall be brushed over the gasket and the plain end of the pipe for push on joints and mechanical joints, where needed.
 3. Backhoe buckets or excavation equipment are not to be applied directly to the pipe.
 4. Mechanical joints shall be assembled in accordance with AWWA Standards. Mechanical joints shall be centered in the bells. An approved pipe lubricant shall be brushed over the gasket just prior to installation. The gasket and gland shall be placed in position, the bolts inserted, and the nuts tightened by hand.
 5. The bolts shall be tightened on opposite sides of the pipes by means of a torque wrench in such a manner that the gland shall be brought up evenly into the joint. The following range of bolt torques shall be applied:

<u>Bolt Size (Inches)</u>	<u>Range of Torque</u>
¾-inch Diameter	5 to 95 ft.-lbs.
1-inch Diameter	95 to 100 ft.-lbs.
 6. If effective seal is not obtained at a maximum torque listed above, the joint shall be disassembled and reassembled after thorough cleaning.

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7. If a joint is defective, it shall be cut out and entirely replaced or, if permission is given by the County, it may be repaired by a suitable clamp.
- M. Expediting of Work: Excavate, lay the pipe, and backfill as closely together as possible. Do not leave un-joined pipe in the trench overnight. Backfill and compact the trench as soon as possible after laying and jointing is completed. Cover the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress. If necessary to backfill over the end of an uncompleted pipe or accessory, close the end with a suitable plug, either push-on, mechanical joint, restrained joint or as approved by the County.
- N. V-Bio Polyethylene Encasement: Installation shall be in accordance with AWWA C105 and the manufacturer's instructions. All ends shall be securely closed with tape and all damaged areas shall be completely repaired to the satisfaction of the County. Installation shall be at locations shown on the Drawings.
- O. Conflict with Existing Utilities
1. Horizontal Conflict: Horizontal conflict shall be defined as when the actual horizontal separation between a utility, main, or service and the proposed reclaimed water main does not permit safe installation of the reclaimed water main by the use of sheeting, shoring, supporting, or temporarily suspending service of the parallel or crossing facility. The Contractor may change the proposed alignment of the reclaimed water main to avoid horizontal conflicts if the new alignment remains within the available right-of-way or easement, complies with regulatory agency requirements and after a written request to and subsequent approval by the County. If, in the opinion of the County, the reclaimed water main's proposed location cannot be adjusted, thus requiring the relocation of an existing utility, the County will direct the Contractor to relocate the utility as part of the Contract with the costs of such relocation being paid for as part of a change order. Separation of reclaimed water, reclaimed water, storm and sewer systems shall comply with FDEP regulations and Standard Drawings.
 2. Vertical Conflict: Vertical conflict shall be defined as when the actual vertical separation between a utility, main, or service and the proposed reclaimed water main does not permit the crossing without immediate or potential future damage to the utility, main, service, or the reclaimed water main. The Contractor may change the proposed grade of the reclaimed water main to avoid vertical conflicts if the changed grade maintains adequate cover and complies with regulatory agencies requirements after written request to and subsequent approval by the County. If, in the opinion of the County, the reclaimed water main's proposed location cannot be adjusted, thus requiring the relocation of an existing utility, the County will direct the Contractor to relocate the utility as part of the Contract with the costs of such relocation being paid for as part of a change order. Separation of reclaimed water, reclaimed water, storm and sewer systems shall comply with FDEP regulations and STANDARD DRAWINGS.

- P. Electronic Locator: Have available at all times an electronic pipe locator and a magnetic locator, in good working order, to aid in locating existing pipe lines or other obstructions.
- Q. Reclaimed water Main Separation Requirements (See Utilities Standard Detail G-14)
1. Reclaimed water mains constructed in Bay County Rights-of-way shall be laid to provide a minimum horizontal distance of at least three feet between the outside of the reclaimed water main and the outside of any existing or proposed vacuum-type sanitary sewer, storm sewer, storm water force main, or pipeline conveying reclaimed water. A horizontal distance of at least 10 feet shall be provided between the outside of the reclaimed water main and the outside of any existing or proposed gravity-type sanitary sewer, pressure-type sanitary sewer, wastewater force main, or pipeline conveying reclaimed water. A horizontal distance of at least ten feet shall be provided between the outside of the reclaimed water main and all parts of any existing or proposed "on-site sewage treatment and disposal system."
 2. Reclaimed water mains constructed in Bay county Right-of way, that will cross any existing or proposed gravity- or vacuum-type sanitary sewer or storm sewer will be laid so the outside of the reclaimed water main is at least six inches above the other pipeline or at least 12-inches below the other pipeline. Reclaimed water mains that will cross any existing or proposed pressure-type sanitary sewer, wastewater or storm water force main, or pipeline conveying reclaimed water will be laid so the outside of the reclaimed water main is at least 12-inches above or below the other pipeline.
 3. At the utility crossings described above, one full length of reclaimed water main pipe will be centered above or below the other pipeline so the reclaimed water main joints will be as far as possible from the other pipeline or the pipes will be arranged so that all reclaimed water main joints are at least three feet from all joints in vacuum-type sanitary sewers, storm sewers, or storm water force mains, and at least six feet from all joints in gravity or pressure-type sanitary sewers, wastewater force mains, or pipelines conveying reclaimed water.

3.3 Installation of Fittings, Valves and Taps

- A. Fittings shall be handled with care to avoid damage. All fittings shall be loaded and unloaded by lifting, and under no circumstances shall fittings be dropped, skidded, or rolled. Under no circumstances shall fittings be placed against pipe or other fittings in such a manner that damage could result. Slings, hooks, or tongs used for lifting shall be padded in such a manner as to prevent damage to exterior surface or interior lining of fittings. If any part of the fittings' coating or lining is damaged by the Contractor, the repair or replacement shall be made by the Contractor at his expense and in a manner satisfactory to the County before installing. Fittings shall also be stored at all times in a safe manner to prevent damage and kept free of dirt, mud, or other foreign matter. All fitting gaskets shall be stored and placed in a cool

location out of direct sunlight and out of contact with petroleum products. All gaskets shall be used on a first-in, first-out basis.

- B. Fittings shall be set and joined to the pipe in a manner specified previously for joint assembly. When conditions warrant, fittings should be provided with special support trussing and blocking. Buried valves that are 12-inches and larger valves shall be provided with special support, such as treated timbers, crushed stone, concrete pads or a sufficiently tamped trench bottom so that the pipe will not be required to support the weight of the valve. Valves shall be installed in the closed position.
- C. Prior to installation, valves shall be inspected for direction of opening, number of turns to open, freedom of operation, tightness of pressure-containing bolting and test plugs, cleanliness of valve ports and especially seating surfaces, handling damage and cracks. Defective valves shall be corrected or held for inspection by the County. Valves shall be closed before being installed.
- D. A valve box shall be provided on each underground valve. They shall be carefully set, centered exactly over the operating nut and truly plumbed. The valve box shall not transmit shock or stress to the valve. The bottom flange of the lower belled portion of the box shall be placed below the valve operating nut. This flange shall be set on brick, so arranged that the weight of the valve box and superimposed loads will bear on the base and not on the valve or pipe. Extension stems shall be installed where depth of bury places the operating nut in excess of 60-inches beneath finished grade so as to set the top of the operating nut 30-inches below finished grade. The valve box cover shall be flush with the surface of the finished area or such other level as directed by the County.
- E. All valve boxes set in non-paved areas shall have concrete pads poured around the top section of the valve box. The pad shall be a 24-inch square and shall be centered on the valve box. All reclaimed water valve covers shall be painted safety blue as prescribed by the American Public Works Association (APWA) uniform color code for utility systems. All valve covers shall be cast with the word RECLAIMED WATER. A 2-inch monument will be set on the North East corner of each 24-inch poured square pad of the valve box indicating the valve size, type, and number of turns required.
- F. In no case shall valves be used to bring misaligned pipe into alignment during installation. Pipe shall be supported in such a manner as to prevent stress on the valve.
- G. A valve marker shall be provided for each underground valve. Unless otherwise detailed on the Drawings or directed by the County, valve markers shall be installed 6 inches inside the right of way or easement. Raised pavement markers (RPM's) shall be provided and installed along the appropriate roadway centerline for each in-line valve on County owned right-of-way. RPM's for in-line valves shall be Type I, two-way, and white in color.
- H. Blow-Offs: Blow-offs shall not be connected to any sewer or submerged in any stream or be installed in any other manner that will permit back-siphoning of contaminated reclaimed water.

- I. The valve and valve box shall be installed so reclaimed water department personnel can insert a valve key through the valve box and completely open and close the valve.

3.4 Connections to Reclaimed Water Mains

- A. Make connections to existing pipe lines with tapping sleeves and valves, unless specifically shown otherwise on the Drawings.
- B. Location: Before laying pipe, locate the points of connection to existing reclaimed water mains and uncover as necessary for the County to confirm the nature of the connection to be made.
- C. Interruption of Services: Make connections to existing reclaimed water mains only when system operations permit. Operate existing valves only with the specific authorization and direct supervision of the County.
- D. Testing: The County must be present for the pressure test of the tapping saddle and tapping valve before the tap is allowed. Test shall be done through the saddle and the test machine or the saddle and tap valve.
- E. Tapping Saddles and Tapping Sleeves
 1. Holes in the new pipe shall be machine cut, either in the field or at the factory. No torch cutting of holes shall be permitted. The coupon shall be delivered to the County.
 2. Prior to attaching the saddle or sleeve, the pipe shall be thoroughly cleaned, utilizing a brush and rag, as required.
 3. Before performing field machine cut, the reclaimed water tightness of the saddle or sleeve assembly shall be pressure tested. The interior of the assembly shall be filled with reclaimed water. Then using a hydro-static hand pump, pump to a pressure of 150 psi to insure all air is expelled. No leakage shall be permitted for a period of thirty minutes.
 4. After attaching the saddle or sleeve to an existing main, but prior to making the tap, the interior of the assembly shall be disinfected. All surfaces to be exposed to reclaimed water shall be swabbed or sprayed with a one percent hypochlorite solution.
- F. Connections and Repairs: Where connections or repairs are required, Contractor shall only use solid sleeves and provide all materials and labor necessary to make the connection or repair to the existing pipeline, excluding service lines 2-inch or smaller.

3.5 Installation of Fire Hydrants (See Utilities Standard Detail W-2)

- A. Prior to installation, inspect all hydrants for direction of opening, nozzle threading, operating nut and cap nut dimensions, tightness of pressure-containing bolting, cleanliness of inlet elbow, handling damage and cracks. Defective hydrants shall be corrected or held for inspection by the County.
- B. All hydrants shall stand plumb and shall have their nozzles parallel with or at right angles to the roadway, with pumper nozzle facing the roadway, except that hydrants having two-hose nozzles 90 degrees apart shall be set with each nozzle facing the roadway at an angle of 45 degrees.
- C. Hydrants shall be set to the established grade, with the centerline of the lowest nozzle at least 12-inches above the ground or as directed by the County.
- D. Each hydrant shall be connected to the main with a 6-inch branch controlled by an independent 6-inch valve located adjacent to the main. When a hydrant is set in soil that is pervious, drainage shall be provided at the base of the hydrant by first wrapping the weep hole/drain hole with a felt/mesh material that will allow the hydrant to drain. Then place coarse gravel or crushed stone mixed with coarse sand from the bottom of the trench to at least 6-inches above the drain port opening in the hydrant to a distance of 12-inches around the elbow.
- E. When a hydrant is set in clay or other impervious soil, a drainage pit 2 x 2 x 2 feet shall be excavated below each hydrant and filled with coarse gravel or crushed stone mixed with coarse sand under and around the elbow of the hydrant and to a level of 6-inches above the drain port.
- F. Hydrants shall be located as shown on the Drawings or as directed by the County. In the case of hydrants that are intended to fail at the ground-line joint upon vehicle impact, specific care must be taken to provide adequate soil resistance to avoid transmitting shock moment to the lower barrel and inlet connection. In loose or poor load bearing soil, this may be accomplished by pouring a concrete collar approximately 6-inches thick to a diameter of 24-inches at or near the ground line around the hydrant barrel.
- G. Raised pavement markers (RPM's) shall be provided and installed along the appropriate roadway centerline for each fire hydrant on County owned right-of-way. RPM's for inline valves shall be Type I, two-way, and blue in color.

3.6 Thrust Restraint

- A. Retainer Glands: Provide retainer glands at all points where hydraulic thrust may develop and on fire hydrants and all associated fittings, valves and related piping. Retainer glands shall be installed in accordance with the manufacturer's recommendations, particularly; the required torque of the set screws. The Contractor shall furnish a torque wrench to verify the torque on all set screws which do not have inherent torque indicators.

- B. Thrust Collars: Concrete collars shall be constructed as shown on the Drawings. The welded-on collar shall be attached to the pipe by the pipe manufacturer. Filter fabric shall be installed between the thrust collar and the adjacent soil.
- C. Concrete Blocking:
 - 1. Provide concrete blocking for all bends, tees, valves, and other points where thrust may develop, except where other exclusive means of thrust restraint are specifically shown on the Drawings. Filter fabric shall be installed between the concrete blocking and the adjacent soil.
 - 2. Form and pour concrete blocking at fittings as shown on the Drawings and as directed by the County. Pour blocking against undisturbed earth. Increase dimensions when required by over excavation.
- D. Cement Slabs: All 12-inch and larger tap valves will be supported by a poured cement slab. Slab size and thickness to be determined on a case by case basis by engineer and the County.

3.7 Detection Tape and Trace Wire

- A. Provide detection tape and trace wire for all reclaimed water mains.
- B. Detection tape shall be located 18-inches above the crown of the pipe.
- C. Trace wire shall not be wrapped around the pipe.
- D. Trace wire shall be laid parallel to the 12 o'clock position of the main with at least 6-inches of separation.
- E. Trace wire shall be looped into each valve box and pulled out a minimum of two feet from the top of the valve box.

3.8 Reclaim Water Service Connections

- A. Reclaim water service connections shall be installed to the properties adjacent to the reclaimed water transmission mains both to the same side of the roadway (Short Side Service) and to the opposite side of the roadway (Long Side Service) as directed by the County.
- B. Reclaimed water service connections installed under roadway shall be pulled through a casing. Casings shall be installed through a bored hole approximately equal in diameter to the external diameter of the casing. Minimum cover under roadway shall be four feet. At other locations, minimum cover shall be two feet.
- C. Installation shall conform to the details for reclaimed water service connections appearing schematically on the Drawings. Contractor shall provide any and all appurtenant work required to provide the intended reclaimed water service connections.

- D. Transfer of Service: Immediately before connecting to the relocated or existing meter, all service lines shall be flushed to remove any foreign matter. Any special fittings required to reconnect the existing meter, to the new copper service line, or the existing private service line, shall be provided by the Contractor. To minimize out of service time, the Contractor shall determine the connections to be made and have all the required pipe and fittings on hand before shutting off the existing service. After completing the connection, the new corporation stop shall be opened and all visible leaks shall be repaired.
- E. Backflow preventers shall be provided on all reclaimed services. Please refer to Paragraph 2.16(C)10 for further backflow specifications.
- F. GPS coordinates shall be provided for each service connection and lateral.

3.9 Testing, Flushing and Inspection Requirements

- A. It will be the responsibility of the Contractor to coordinate all testing, flushing and inspections. The Contractor shall notify the County and applicable agency inspectors 48 hours in advance of testing, flushing and inspections.

3.10 Hydrostatic Test

- A. All sections of the reclaimed main subject to internal pressure shall be pressure tested in accordance with AWWA C600. A section of main will be considered ready for testing after completion of all thrust restraint and backfilling.
- B. All tests shall be in the presence of the County.
- C. Each segment of reclaimed main between main valves shall be tested individually.
- D. Test Preparation
 1. Flush sections thoroughly at flow velocities, greater than 2.5 feet per second, adequate to remove debris from pipe and valve seats.
 2. Fully operate valves and hydrants to clean out seats.
 3. Provide temporary blocking, bulkheads, flanges and plugs as necessary, to assure all new pipes, valves and appurtenances will be pressure tested.
 4. Before applying test pressure, air shall be completely expelled from the pipeline and all appurtenances. Insert corporation cocks at highpoints to expel air as main is filled with reclaimed as necessary to supplement automatic air valves. Corporation stops shall be constructed as detailed on the Drawings with a meter box.
 5. Fill pipeline slowly with reclaimed. Provide a suitable pump with an accurate reclaimed meter to pump the line to the specified pressure.

6. The differential pressure across a valve or hydrant shall equal the maximum possible, but not exceed the rated working pressure. Where necessary, provide temporary backpressure to meet the differential pressure restrictions.
 7. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure.
- E. Test Pressure: Test the pipeline at 150 psi or 1.5 times the operating pressure, whichever is greater, measured at the lowest point for at least two hours. Maintain the test pressure within 5 psi of the specified test pressure for the test duration (at least two hours). Should the pressure drop more than 5 psi at any time during the test period, the pressure shall be restored to the specified test pressure. Provide an accurate pressure gauge with graduation not greater than 5 psi.
- F. Leakage
1. Leakage shall be defined as the sum of the quantity of reclaimed that must be pumped into the test section, to maintain pressure within 5 psi of the specified test pressure for the test duration. Leakage shall be the total cumulative amount measured on a reclaimed meter.
 2. The County assumes no responsibility for leakage occurring through existing valves.
- G. Test Results: No test section shall be accepted if the leakage exceeds the limits determined by the following formula:

$$L = \frac{SD \sqrt{P}}{133,200}$$

Where: L = allowable leakage, in gallons per hour

S = length of pipe tested, in feet

D = nominal diameter of the pipe, in inches

P = average test pressure during the leakage test, in pounds per square inch (gauge)

As determined under Section 4 of AWWA C600.

Allowable leakage at various pressures and pipe sizes is shown in the Table below (from AWWA C600 – Table 4.A) for 1000' of Pipe: *

Avg. Average Pressure (PSI)	Pipe Diameter (inches)												
	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"	24"	30"	36"
250	0.32	0.43	0.64	0.85	1.07	1.28	1.50	1.71	1.92	2.14	2.56	3.21	3.85
225	0.30	0.41	0.61	0.81	1.01	1.22	1.42	1.62	1.82	2.03	2.43	3.04	3.65
200	0.29	0.38	0.57	0.76	0.96	1.15	1.34	1.53	1.72	1.91	2.29	2.87	3.44
175	0.27	0.36	0.54	0.72	0.89	1.07	1.25	1.43	1.61	1.79	2.15	2.68	3.22
150	0.25	0.33	0.50	0.66	0.83	0.99	1.16	1.32	1.49	1.66	1.99	2.48	2.98
125	0.23	0.30	0.45	0.60	0.76	0.91	1.06	1.21	1.36	1.51	1.81	2.27	2.72
100	0.20	0.27	0.41	0.54	0.68	0.81	0.95	1.08	1.22	1.35	1.62	2.03	2.43

*If the reclaimed main section being tested contains lengths of various pipe diameters, the allowable leakage shall be the sum of the computed leakage for each diameter. The leakage test shall be repeated until the test section is accepted. All visible leaks shall be repaired regardless of leakage test results.

- H. Completion: After a pipeline section has been accepted, relieve test pressure. Record type, size and location of all outlets on record drawings.
- I. Re-Testing: Any alterations made to pipeline performed after initial testing shall be re-tested and passed again, regardless of initial test results.
- J. Notification: Bay County shall be notified 24-hours in advance prior to Contractor performing pressure and leakage testing.

3.11 Trace Wire Continuity Test

- A. Prior to acceptance of pressure pipe by the County, the Contractor shall demonstrate that the locator tracer wire functions properly. During the tracer wire testing, the Contractor shall also demonstrate that the wire is connected to all services at meter boxes, hydrants, backflow preventers, butterfly valves, wastewater plug valves, tapping valves, air release valves, and blow-off valves. The Contractor shall use one of several commercially available utility locating instruments to energize and trace the locator wire for continuity. Direct signal locate method shall directly apply the current from the transmitter to the tracer wire and the signal shall be detected and followed with a receiver. Submit to the County Inspector for approval the method and equipment to be used. Testing of the locator wire shall be done prior to or concurrent with the hydrostatic pressure test.

3.12 Disinfecting Pipeline

- A. After successfully pressure testing each pipeline section, disinfect in accordance with AWWA C651 for the continuous-feed method and these Specifications.

- B. Specialty Contractor: Disinfection shall be performed by an approved specialty contractor. Before disinfection is performed, the Contractor shall submit a written procedure for approval before being permitted to proceed with the disinfection. This plan shall also include the steps to be taken for the neutralization of the chlorinated reclaimed water.
- C. Chlorination
1. Apply chlorine solution to achieve a concentration of at least 25 milligrams per liter free chlorine in new line. Retain chlorinated reclaimed for 24 hours.
 2. Chlorine concentration shall be recorded at every outlet along the line at the beginning and end of the 24 hour period.
 3. After 24 hours, all samples of reclaimed water shall contain at least 10 milligrams per liter free chlorine. Re-chlorinate if required results are not obtained on all samples.
- D. Disposal of Chlorinated Reclaimed water: Reduce chlorine residual of disinfection reclaimed water to less than one milligram per liter if discharged directly to a body of reclaimed water or to less than two milligrams per liter if discharged onto the ground prior to disposal. Treat reclaimed water with sulfur dioxide or other reducing chemicals to neutralize chlorine residual. Flush all lines until residual is equal to existing system.
- E. Bacteriological Testing
1. After final flushing and prior to DEP approval and the reclaimed water main being placed into service, the Contractor shall collect samples from the line and have tested for bacteriological quality in accordance with the rules of the Florida Department of Environmental Protection.
 2. The Contractor shall give Bay County Utilities 48-hour written notice of the planned bacteriological testing to facilitate public notification, if required. A County representative must be present when bacteriological samples and free and total chlorine residual are taken. Immediately after samples are taken, the Contractor will be responsible for delivering the samples to the Laboratory for testing. The bacteriological samples shall be analyzed for both coliform and non-coliform growth. Testing shall be performed by a laboratory certified by the State of Florida and approved by the County.
 3. All sampling and testing costs shall be paid for by the Contractor prior to final acceptance.
 4. Re-chlorinate lines until required results are obtained.
 5. All testing must follow FDEP 62-555.900 guidelines.

END OF SECTION

Part 1 General

1.1 Scope

- A. This Section describes products to be incorporated into sewers and accessories and requirements for the installation and use of these items. Furnish all products and perform all labor necessary to fulfill the requirements of these Specifications.
- B. In general Bay County will require a Gravity Collection System, however, if the engineer can thoroughly justify that a gravity system is not feasible, Bay County will consider a Vacuum System first, and a Low Pressure Sewer System (LPSS) second for the development. The County may require the Engineer provide a cost analysis prior to approval of LPSS.

1.2 Description of Work

- A. Extent of sewer collection system work is shown on the drawings.
- B. Sewer collection system work includes but is not limited to sanitary sewer mains, sewer laterals (services), manholes, frames, and covers.

1.3 Quality Assurance

- A. Codes and Standards: Perform all work in compliance with applicable requirements of governing authorities having jurisdiction and the applicable standards of the American Water Works Association (AWWA), American National Standards Institute (ANSI), and the American Society for Testing and Materials (ASTM), latest editions.
- B. Testing and Inspection
 - 1. Leakage testing and deflection shall be performed by the Contractor. All gravity sewer lines will be videoed by the contractor and copy of the report and video will be provided to the County via USB memory drive. General inspection and flushing lines shall be performed by the Contractor with County Inspector present.

It will be the responsibility of the Contractor to coordinate all testing and inspections. The Contractor shall notify the County, testing service, and applicable agency inspectors 48 hours in advance of testing and inspections.
- C. Deed Requirements (only applies to Low Pressure Sewer Systems): The following language in the deed is required; "Grinder Pump System is required at this location, it is the sole responsibility of the owner to maintain the grinder system to the property line".

1.4 Submittals

- A. Prior to beginning construction, the Contractor shall submit manufacturer's certifications and cut sheets for approval by the County for the following applicable items: sanitary sewer pipe, fittings, service laterals, clean outs, manhole and manhole frames and covers.

Part 2 Products

2.1 General

- A. All materials shall be in accordance with the Material Standard and shall, in no event, be less than that necessary to conform to the requirements of any applicable laws, ordinances, and codes.
- B. All materials shall be new, unused, and correctly designed. They shall be of standard, first grade quality and intended for the use for which they are offered. Materials or equipment which, in the opinion of the County, are inferior or of a lower grade than indicated, specified, or required will not be accepted.

2.2 HDPE Pipe

- A. Pipe: 12- through 30-inch pipe shall be DIPS DR11 pressure class 200.
- B. Joints: Pipe shall have butt-fused restrained joints to transition to mechanical joints.
- C. Pipe Marking: All HDPE pipes for sewer shall have a green stripe at third points around the circumference of the pipe for its full length parallel to the centerline of the pipe.
- D. Coatings: Not required.
- E. Cutting: HDPE sewer pipe may be field cut using hand or power saws in accordance with the manufacturer's recommendations. The raw spigot end thus formed shall be filed to remove gasket damaging burrs and to form a standard bevel.
- F. Fittings: Fittings shall conform to ASTM F2619. Bell and spigot connections shall utilize a spun-on, welded or integral bell and spigot with gaskets meeting ASTM F477. Fitting joints shall meet the watertight joint performance requirements of ASTM D3212.

2.3 Polyvinyl Chloride (PVC) Pipe

- A. Pipe: PVC pipe shall be manufactured in accordance with ASTM D3034 and ASTM D1784. All PVC pipe shall meet the dimension requirements of standard dimension ratio (SDR) 26.

- B. Joints: Joints for PVC sewer pipe shall be of the bell and spigot type conforming to ASTM D3212 using factory installed flexible elastomeric seals. The elastomeric seals shall conform to ASTM F477.
- C. Pipe Marking: All pipe shall be marked as prescribed in ASTM D2241 (e.g., nominal pipe size, type of plastic pipe material, pipe dimension ratio, pressure rating, ASTM specification designation number manufacturer's name and code).
- D. Coatings: Not required.
- E. Cutting: PVC sewer pipe may be field cut using hand or power saws in accordance with the manufacturer's recommendations. The raw spigot end thus formed shall be filed to remove gasket damaging burrs and to form a standard bevel.
- F. Fittings: PVC sewer pipe fittings shall comply with ASTM D3034, ASTM 3212, and have elastomeric seals conforming to ASTM F477.
- G. All PVC pipe for sewer shall be green, which shall be throughout the pipe wall.

2.4 Solid Sleeves

- A. Solid sleeves shall permit the connection of plain end ductile iron pipe and plain end PVC pipe. Solid sleeves shall meet the requirements of ANSI/AWWA C110 for long pattern and have a minimum pressure rating of 250 psi. Solid sleeves shall have a mechanical or restrained joint as specified in this Section and as shown on the Drawings. All Ductile Iron Solid Sleeves, and Mechanical Joint Fittings, will be lined with EMD Permox CTF, Perma-Shield PL Series 431, or approved equal. Solid sleeves shall be provided with gaskets suitable for the type of pipe to be connected. Solid sleeves shall be used only in locations shown on the Drawings or at the direction of the County. Solid sleeves shall be manufactured by ACIPCO or U.S. Pipe.

2.5 Flexible Adaptor Couplings (Only Used on Gravity Sewer Lines)

- A. Couplings for pipe sizes 15-inches in diameter and less shall be elastomeric plastic sleeves designed to connect pipes of same or dissimilar materials. Adapters shall provide a positive seal against infiltration and exfiltration and remain leak proof and root proof up to 4.3 psi. The adaptor manufacturer shall provide a full jacket stainless steel clamps and required accessories.
- B. Couplings shall be products of Fernco with stainless steel shear ring and shall be installed in accordance with the manufacturer's recommendations.

Part 3 Execution

3.1 Existing Utilities and Obstructions

- A. The Drawings indicate utilities or obstructions that are known to exist according to the best information available to the County. The Contractor shall call the Sunshine

State One Call of Florida, Inc. (1-888-761-3042), as required by Florida Law and all utilities, agencies or departments that own and/or operate utilities in the vicinity of the construction work site, at least 72 hours (three business days) prior to construction, to verify the location of the existing utilities.

B. Conflict with Existing Utilities

1. Horizontal Conflict: Horizontal conflict shall be defined as when the actual horizontal separation between a utility, main, or service and the proposed sewer line does not permit safe installation of the sewer line by the use of sheeting, shoring, tie-back, supporting, or temporarily suspending service of the parallel or crossing facility. The County will determine if the alignment can be changed to avoid the conflict. If, in the opinion of the County, the sewer line's proposed location cannot be adjusted, thus requiring the relocation of an existing utility, the County will direct the Contractor to relocate the utility as part of the Contract with the costs of such relocation being paid for as part of a change order.
2. Vertical Conflict: Vertical conflict shall be defined as when the actual vertical separation between a utility, main, or service and the proposed sewer line does not permit the crossing without immediate or potential future damage to the utility, main, service, or the sewer line. The County will determine if the grade can be adjusted to avoid the conflict. If, in the opinion of the County, the sewer line's proposed location cannot be adjusted, thus requiring the relocation of an existing utility, the County will direct the Contractor to relocate the utility as part of the Contract with the costs of such relocation being paid for as part of a change order.

C. Electronic Locator: The Contractor shall have available at all times an electronic pipe locator and a magnetic locator, in good working order, to aid in locating existing pipe lines or other obstructions.

D. Sewer Collection System Separation Requirements

1. Newly constructed sewers and force mains shall be laid at least ten feet (outside to outside) horizontally from water mains. If there is no reasonable alternative, smaller horizontal separation distances may be allowed if one of the following conditions is met:
 - a. The top of the sewer is installed at least 18 inches below the bottom of the potable water line.
 - b. The sewer is encased in watertight carrier pipe or concrete.
 - c. Both the sewer and the water main are constructed of slip-on or mechanical joint pipe complying with public water supply design standards and pressure tested to 150 psi to assure water tightness.
 - d. Documentation is provided showing that another alternative will result in an equivalent level of reliability and public health protection.

2. Newly constructed sewers and force mains shall be laid at least three feet (inside edge to inside edge) horizontally from any existing or proposed reclaimed water lines.
3. Newly constructed sewer pipes and force mains shall cross under water mains, unless there is no alternative. Sewers and force mains crossing water mains or reclaimed water lines shall be laid to provide a minimum vertical distance of 18 inches between the invert of the upper pipe and the crown of the lower pipe. The minimum vertical separation shall be maintained whether the water main is above or below the sewer. For sewer crossings, the crossing shall be arranged so that the sewer pipe joints are equidistant and as far as possible from the water main joints. Adequate structural support shall be provided for the sewer or force main to maintain line and grade. If there is no reasonable alternative, smaller vertical separation distances may be allowed if one of the following conditions is met:
 - a. The sewer is encased in a watertight carrier pipe.
 - b. The sewer is designed and constructed equal to water pipe and pressure tested to 150 psi to assure water tightness.
 - c. Documentation is provided showing that another alternative will result in an equivalent level of reliability and public health protection.

3.2 Pipe Distribution

- A. Pipe shall be distributed and placed in such a manner that will not interfere with traffic.
- B. No pipe shall be strung further along the route than 1,000 feet beyond the area in which the Contractor is actually working without written permission from the County. The County reserves the right to reduce this distance to a maximum distance of 200 feet in residential and commercial areas based on the effects of the distribution to the adjacent property owners.
- C. No street or roadway may be closed for unloading of pipe without first obtaining permission from the proper authorities. The Contractor shall furnish and maintain proper warning signs and obstruction lights for the protection of traffic along highways, streets and roadways upon which pipe is distributed.
- D. No sewer pipes shall be placed inside drainage ditches.
- E. Sewer pipes shall be placed as far as possible from the roadway pavement, but no closer than five feet from the roadway pavement, as measured inside edge to inside edge.

3.3 Installation of Pipe

- A. General: Upon satisfactory installation of the pipe bedding, as specified in the "Earthwork for Utilities" section of these specifications, a continuous trough for the pipe barrel and recesses for the pipe joints shall be excavated by hand digging so that, when the pipe is laid in the trench true to line and grade, the pipe barrel will receive continuous, uniform support, and the joint will receive no pressure from the trench bottom.
- B. HDPE Pipe: Installation shall be in accordance with the manufacturer's recommendations and ASTM D2321.
- C. Polyvinyl Chloride Pipe: Installation shall be in accordance with the recommended practices in ASTM D2321.
- D. Transportation: Care shall be taken during transportation of the pipe so that it is not cut, kinked, or otherwise damaged.
- E. Handling Pipe Lengths: Ropes, fabric, or rubber-protected slings and straps shall be used when handling pipes.
- F. Special Precautions: Polyvinyl chloride pipe connected to heavy fittings, manholes, and rigid structures shall be supported in such a manner that no subsequent relative movement between the pipe and the joint with the rigid structures is possible.
- G. The interior of all pipe shall be thoroughly cleaned of all foreign material before being lowered into the trench and shall be kept clean during laying operations by means of plugs or other approved methods.
- H. Pipe laying shall proceed upgrade with spigot ends pointing in the direction of flow. Before pipe is joined, gaskets shall be cleaned of all dirt, stones and other foreign material. The spigot ends of the pipe shall be lubricated lightly with a lubricant specified by the pipe manufacturer and approved by the County. Sufficient pressure shall be applied to the pipe so as to properly seat the socket in the bell of the pipe. All pipe shall be laid straight, true to the lines and grades shown on the drawings in each manhole section.
- I. Under no circumstances shall pipe be laid in water or when trench conditions or the weather is unsuitable for such work, except by permission of the County. At all times when work is not in progress, the exposed ends of all pipes shall be fully protected by a board or other approved stopper to prevent earth or other substances from entering the pipe.
- J. Lowering Pipe Into Trench: Care shall be exercised when lowering pipe into the trench to prevent damage to, or twisting of, the pipe.
- K. After each pipe is laid, it shall be partly backfilled and made secure before the next joint is laid.

- L. Any pipe which is disturbed or found to be defective after laying shall be removed and relayed or replaced at the Contractor's expense. Sun bleached PVC Pipe is considered defective.
- M. Whenever pipe laying is stopped for the night or for any other cause, the end of the pipe shall be securely closed with a stopper to prevent the entrance of water, mud, or other obstructing matter, and shall be secured in such a manner as to prevent the end pipe from being dislodged by sliding or other movement from the backfilling.
- N. Interior Inspection: The Contractor shall inspect pipe to determine whether line displacement or other damage has occurred. The Contractor shall pull a 12-inch long mandrel through the pipe to make sure the pipe has not been deflected during compaction or has a belly in it. The Contractor shall make inspections after lines between manholes, or manhole locations have been installed and approximately two feet of backfill is in place and at completion of project. If inspection indicates poor alignment, debris, displaced or deflected pipe, infiltration or other defects, correct such defects to satisfaction of County. All gravity sewer pipes and manholes shall be audio video recorded and the audio video shall be provided to the County on a USB memory drive.
- O. Prior to connecting new work to existing lines or appurtenances, the Contractor shall verify location and elevations of existing connection point and notify County of any conflicts or discrepancies.
- P. All sewer laterals shall be located a minimum of 36 inches below grade and at greater depths as required to provide service.
- Q. Long radius wyes or tees of specified diameter shall be inserted in the sewer lines to provide service to each lot or wherever designated by the County.
- R. Where new laterals are specified on the plans, or instructed to be installed by the County, they shall be laid to the edge of the right-of-way or as the County may direct. The location of the lateral at the right-of-way shall be recorded on the record drawings. In sewers over eight feet in depth, or where directed, stacks shall be carried up from the wye connections at a maximum angle of 45 degrees. The ends of the stacks or laterals shall be closed with plugs or covers. Materials for stacks and laterals shall be as shown on the details or designated in the proposal.
- S. Wherever existing house laterals are encountered or identified by the County to be installed, they shall be replaced and connected to the existing lateral at the edge of right-of-way. A new PVC cleanout, as shown on typical wye with a PVC glued cap, lateral installation shall be installed. If necessary, the new lateral could be plugged with a pneumatic plug for pressure testing the sewer main; however, under no circumstances should the lateral be plugged for more than one hour. Additionally, it shall be the Contractor's responsibility to notify the resident 24 hours prior to such outage. House laterals are not to be shared between houses.
- T. Wherever house laterals are intercepted by the excavation for the new sewer, connection shall be maintained temporarily to the old sewer until the particular section of new sewer is completed, tested, and approved. The house lateral shall

then be broken and reconnected to the new sewer through a wye which shall have been placed in the new sewer for that purpose.

- U. The dead end of the house lateral shall be capped with a cover or plug as specified on the drawings. The covers or plugs shall have a factory-molded joint of the same type as used for the lateral pipe, and shall be of the same material. Record the location of all laterals at the right-of-way and place the information on the record drawings.

3.4 Storage and Handling Pipe

- A. Storage: Pipes shall be stored on level ground, preferably turf or sand, free of sharp objects which could damage the pipe.
- B. Stacking of polyvinyl chloride pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperature conditions. Where necessary, due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such width as not to allow deformation of the pipe at the point of contact with sleeper or between supports.
- C. Handling Pipe: The handling of pipe shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Sections of the pipe with deep cuts and gouges shall be rejected and removed.

3.5 Closing Abandoned Utilities

- A. Close open ends of abandoned underground utilities which are indicated to remain in place. Provide sufficiently strong closures to withstand hydrostatic or earth pressure which may result after ends of abandoned utilities have been closed.
- B. Close open ends of concrete or masonry utilities with not less than 8-inch thick brick masonry bulkheads.
- C. Close open ends of conduit with plastic plugs, or other acceptable methods suitable for size and type material being closed. Wood plugs are not acceptable.

3.6 Connection to an Existing Manhole

- A. Connection to an existing manhole shall be made by mechanically coring into the wall structure of the manhole. Cored opening shall be sized to properly accommodate a rubber boot seal as specified in this Section. The manhole is to be lined if it is going to be used for a force main or a grinder station. The liner shall be epoxy or fiberglass. No house lateral shall be terminated unless it goes into a dead end manhole.

3.7 Testing Requirements

- A. General

1. The Contractor shall perform one or more required tests and shall furnish all apparatus and materials needed for these tests, the cost of which shall be included in the appropriate bid item.
 2. After backfilling has been completed, the pipes cleaned and before permanent paving has been installed, the Contractor shall complete required testing to ascertain that there are no broken pipes, leaking joints or deflected pipe sections. Pipes failing these tests shall be repaired or replaced by the Contractor to meet requirements of project documents.
 3. The sewer lines and laterals shall be tested for leakage between manholes as the work progresses by one of the following methods as determined by the County. The low pressure air test will be used unless field conditions warrant otherwise.
 - a. Infiltration Test
 - b. Low Pressure Air Test
 4. A deflection test, using a mandrel, will be required for PVC pipe in addition to the above leakage tests.
 5. The Contractor shall check alignment by “flushing” the lines. All gravity pipes will be audio video recorded and copy shall be provided to the County on a USB memory drive.
 6. All tests will be witnessed by the County. The Contractor shall notify the County at least 48 hours in advance of testing.
 7. The County may also “flash” the lines for verification of alignment at their own expense. The pipe line will be rejected if a full diameter is not visible from manhole to manhole.
- B. Low Pressure Air Test Method (6-24 inches)
1. Low pressure air test of sewers and laterals shall be as specified hereinafter. Each manhole run will be tested separately as the construction progresses, before trench surface restoration, and preferably with not more than four manhole runs constructed ahead of testing.
 2. Equipment shall be as manufactured by Cherne Industries, Inc., of Minneapolis, MN; or equal. Equipment used shall meet the following minimum requirements:
 - a. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested.
 - b. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.

- c. All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be used. Air shall be introduced into the plugs to 25 psig. The sealed pipe shall be pressurized, as noted below. The plugs must hold against this pressure without having to be braced.
 - d. All air used shall pass through a single control panel.
 - e. Three individual hoses shall be used for the following connections:
 - f. One hose from control panel to pneumatic plugs for inflation.
 - g. One hose from control panel to sealed line for introducing the low-pressure air.
 - h. One hose from sealed line to control panel for continually monitoring the air pressure rise in the sealed line.
3. Procedures
- a. After a manhole reach of pipe including laterals has been backfilled in accordance with the specifications, the pipe cleaned, and the pneumatic plugs have been checked by the above procedure, the plugs shall be placed in the line at each manhole and inflated to 25 psig. Low-pressure air shall be introduced into this sealed line until the internal air pressure reaches 4 psig greater than the average ground water back pressure. At least two minutes shall be allowed for the air pressure to stabilize.
 - b. After the stabilization period the pressure can be reduced to 3.5 psig prior to starting the test., the air hose from the control panel to the air supply shall be disconnected. The portion of the sanitary sewer (line) being tested shall be termed "Acceptable," if the time required in minutes is greater than the times indicated in the following table for the pressure to decrease from 3.5 psig (greater than the average ground water back pressure) to 2.5 psig (greater than the average ground water back pressure) or drop 1 psig if the start pressure is greater than 3.5 psig. If a leak is detected, a segment test will be completed to determine which joint(s) are leaking.

**Table 1 (from ASTM F1417)
Minimum Specified Time Required for a 1.0 psig Pressure Drop for Size and Length of
Pipe Indicated for Q=0.0015**

Pipe Diameter In.	Minimum Time Min:s	Length For Min. Time, ft.	Time for Longer Lengths; s	Specification Time for Length (L) Shown, min:s							
				100 ft.	150 ft.	200 ft.	250 ft.	300 ft.	350 ft.	400 ft.	450 ft.
4	3:46	597	0.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

- c. In areas where a high groundwater table (groundwater back pressure) is known to exist, the Contractor shall install a 1/2 inch diameter capped pipe nipple, approximately 10 inches long, through the manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the Line Acceptance Test, the groundwater shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the nipple. The plastic tube shall be held vertically and a measurement of the height in feet of water over the invert of the pipe shall be taken after the water has stopped rising in this plastic tube. The height of water in the plastic tube in feet shall be divided by 2.31 to establish the pounds of groundwater back pressure that will be added to all readings. (For example, if the height of water is 11-1/2 feet, then the added groundwater back pressure shall be 5 psig. This increases the 3.5 psig to 8.5 psig, and the 2.5 psig to 7.5 psig. The allowable drop of one pound and the timing remain the same as defined in Table 1.) Should the Contractor desire to use an alternate method for establishing back pressure due to high water details may be provided to the County for review and consideration of approval.)
- d. The Contractor shall keep records of all tests made. Copy of such records will be given to the County. Such records shall show date, line number and stations, operator, and such other pertinent information as required by the County.

C. Deflection Test – PVC only

1. General

- a. Deflection testing shall be performed on all portions of the PVC sewer system. This test shall be performed in sections between manholes at least 30 days after final backfilling has been completed.
 - b. Deflection testing shall be performed in accordance with the procedure outlined below.
2. Maximum Deflection
 - a. The maximum allowable deflection for all installed PVC sewer pipe shall not exceed 5% of the pipe's original internal diameter.
 3. Testing Apparatus
 - a. All PVC sewer pipe shall be tested by the Contractor and at his expense for diametric deflection using a GO-NO-GO type mandrel or other approved method. The mandrel shall have an outside diameter of no less than 95% of the PVC pipe inside diameter. No allowances will be made for standard pipe deflections noted in the manufacturer's specifications. The size of mandrel shall be determined by the following: Pipe inside diameter x 0.95. Any section not allowing passage of said mandrel shall be deemed unacceptable. The Contractor shall, at his expense, determine the location and extent of the problem and make repairs or re-lay the line segment as determined by the County. This test procedure, in accordance with these Specifications, will be repeated after a problem has been corrected. This testing shall be accomplished prior to final acceptance.

Nominal Size	Average I.D.	Base I.D.	Minimum Mandrel Diameter
ASTM SDR 35			
8	7.920	7.665	7.28
10	9.900	9.563	9.08
12	11.780	11.361	10.79
15	14.426	13.898	13.20
ASTM F 679			
18	17.629	16.976	16.13
21	20.783	20.004	19.00
24	23.381	22.480	21.36
27	26.351	25.327	24.06

(All Dimensions in inches)

4. Deflection Testing Procedure
 - a. Completely flush the line making sure the pipe is clean of any mud or debris that would hinder the passage of the mandrel.
 - b. During the final flushing of the line, attach a floating block or ball to the end of the mandrel pull rope and float the rope through the line. (A braided nylon rope is recommended).

- c. After the rope is threaded through the line, connect the pull rope to the mandrel and place the mandrel in the entrance of the pipe.
- d. Connect a retrieval rope to the back of the mandrel to pull it back if necessary.
- e. Remove all the slack in the pull rope and place a tape marker on the rope at the ends of the pipe.
- f. Draw mandrel through the sewer line. If any irregularities or obstructions are encountered in the line, corrective action shall be taken as required.
- g. If a section with excessive deflection is found, it shall be located and excavated. The pipe shall be inspected for damage; if any damaged pipe is found, it shall be replaced at the Contractor's expense; if pipe is not damaged, replace and thoroughly tamp the haunching and initial backfill; replace remainder of backfill.
- h. Re-test this section for deflection.

D. Flushing Lines

- a. Upon completion, and in the presence of the County, the sewer lines shall be flushed between manholes. In each section of the sewer, a round circle of light, full diameter, shall remain constantly in plain view throughout the entire length. The test shall be applied for each section after the sewer is completed in all respects and before it is accepted.

E. Test Failures

1. If the installation fails to meet the stated test requirements, the Contractor at his own expense shall determine the source of leakage, repair or replace all defective materials and/ or workmanship failing to meet tests and shall retest same until it is proven that installation meets requirements of project documents as determined by the County.
2. In the event the test results are not within the allowable range of acceptance, the Contractor shall take whatever corrective action is necessary including replacement of the said pipe, etc., to bring the test results within the allowable range of acceptance at no cost to the County.

END OF SECTION

Part 1 General

1.1 Scope

- A. This Section describes products to be incorporated into force mains, pressure sewers, and accessories and requirements for the installation and use of these items. Furnish all products and perform all labor necessary to fulfill the requirements of these Specifications.

1.2 Description of Work

- A. Extent of work is shown on the drawings.
- B. Sewage force main system work includes, but is not limited to: Piping, valves, fittings, appurtenances.
- C. Comply with the requirements of applicable sections for excavation and backfilling required in connection with sewage force main system work.
- D. Comply with requirements of applicable sections for concrete work required in connection with sewage force main system work.
- E. Force main peak hour discharge into an existing force main shall not cause an increase in velocity beyond 5 fps. If an increase occurs, developer shall participate in relief force main.

1.3 Quality Assurance

- A. Codes and Standards: Perform all work in compliance with applicable requirements of governing authorities having jurisdiction and the applicable standards of the American Water Works Association (AWWA), American National Standards Institute (ANSI), and the American Society for Testing and Materials (ASTM), latest editions.
- B. Testing and Inspection Services
 - 1. Employ, at Contractor's expense, testing laboratory to perform necessary testing.
 - 2. It will be the responsibility of the Contractor to coordinate all testing and inspections. The Contractor shall notify the County, testing service and applicable agency inspectors 48 hours in advance of testing and inspection.
 - 3. Hydrostatic test shall be completed by the Contractor in the presence of the County.

1.4 Submittals

- A. Prior to beginning construction, the Contractor shall submit for approval by the County, manufacturer's certifications and cut sheets for the following items: piping, valves, fittings, and appurtenances.
- B. Test Reports: Submit applicable reports directly to County from the testing service with copy to Contractor.

Part 2 Products

2.1 General

- A. All materials shall be new, unused and correctly designed. They shall be of standard first grade quality and intended for the use for which they are offered. Materials or equipment which, in the opinion of the County, are inferior or of a lower grade than indicated, specified or required, will not be accepted.
- B. HDPE pipe for force mains shall have a green stripe at third points around the pipe for its full length.
- C. PVC pipe for force mains shall be green.

2.2 HDPE Pipe

- A. Pipe of various sizes shall be DIPS SDR 11 Pressure Class (PC) 200 High Density Polyethylene (HDPE) Pipe, AWWA C-906 compliant, and NSF 61 Standard Listed, furnished in fifty (50) foot lengths.
- B. The HDPE pipe shall be manufactured in a plant capable of providing continuous quality control through inspection. The facility shall have the necessary testing equipment to verify that the pipe meets the requirements of AWWA C901 or C906, NSF Standard #61 and ASTM standards.
- C. Materials: Polyethylene pipe and fittings shall be made from resin meeting the requirements of the Plastic Pipe Institute as PE 3608. The resin shall meet the requirements of ASTM D 3350 with a cell classification of 345464C.
- D. All pipes shall be suitable for use as pressure conduits, listed as NSF 61 and per AWWA C906 Pressure Class (PC) 100 have a nominal burst value of three and one-half times the Working Pressure Rating (WPR) of the pipe. Peak flow water velocity of 5 ft./sec shall be used in the hydraulics engineering design.
- E. Butt Fusion Fittings: HDPE fittings shall be PE3608 HDPE, Cell Classification of 345464C as determined by ASTM D 3350, and approved for AWWA use. Butt fusion fittings shall have a manufacturing standard of ASTM D 3261. Molded & fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified in the plans.

- F. Pipe Manufacturer's Quality Control: The pipe manufacturer shall have an on-going Quality Control program for incoming and outgoing materials. High-density polyethylene (HDPE) resins for manufacturing of pipe shall be checked for density, melt flow rate, and contamination. The manufacturer of the HDPE resin shall certify the Cell Classification as indicated above. These incoming resins shall be approved by plant Quality Control and verified to be approved by NSF before being converted to pipe. Pipe shall be checked for outside diameter, wall thickness, length, roundness, and surface finish on the inside and outside and end cut.
- G. Butt Fusion Joining: Plain end pipe and fittings shall be made using butt fusion. The butt fusion procedures shall be in accordance with the manufacturer or the PPI. The fusion equipment operator shall receive training using the recommended procedure. The Contractor shall be responsible to verify that the fusion equipment is in good operating condition and that the operator has been trained within the past twelve months. The fusion equipment shall be equipped with a Data-logger. Records of the welds (heater temperature, fusion pressure, and a graph of the fusion cycle) shall be maintained for five (5) years. Fusion beads shall not be removed.
- H. Other Joining Methods Mechanical Joining. Polyethylene pipe and fittings may be joined together using Flanges or Mechanical Joint (MJ) adapters. These fittings shall be made from PE 3608 HDPE, with a Cell Classification of 345464C as determined by ASTM D 3350. Flanged and MJ adapters shall have a manufacturing standard of ASTM D 3261. They shall have a pressure rating equal to the pipe unless otherwise specified on the plans. All mechanical joints transitioning HDPE to another material shall be restrained using MEGALUG or an approved equal.

2.3 Polyvinyl Chloride (PVC) Pipe

- A. Smaller than 4-inch Pipe: All PVC pipe and fittings less than 4-inches in diameter shall be manufactured in accordance with ASTM D2241 with a standard dimension ration (SDR) of 26 rated pressure 160 psi.
- B. 4-inch through 12-inch Pipe: PVC pipe shall be manufactured in accordance with AWWA C900, latest edition. Pipe shall be pressure Class 235 and must meet dimension requirements of standard dimension ratio (DR) 18.
- C. 14-inch and Larger Pipe: PVC pipe shall be manufactured in accordance with AWWA C905, Latest Edition. Pipe shall be Pressure Class 235 and meet the dimension requirements of dimension ratio (DR) 18.
- D. Joints: Joints shall be "push-on" and shall meet all requirements of ASTM D3139 or locking type. Each bell shall be an integral wall section joint assembly using elastomeric-gasket seals. Restraining gaskets shall be Rieberlock. All gaskets shall meet all requirements for performance as specified by ASTM F477.

2.4 Fittings (3 Inches and Larger)

- A. General: Fittings three inches and larger shall be ductile iron manufactured in accordance with ANSI/AWWA C110/A21.10 or C153/A21.53. The minimum pressure rating for fittings shall be 250 psi.
- B. Joints: Fitting joints shall meet the specifications of the pipe joints as specified under DUCTILE IRON PIPE for the appropriate joint, push on joints, mechanical joints or flange joints.
- C. Coating: All fittings shall receive an interior lining and exterior asphaltic coating as specified under Ductile Iron Pipe. All ductile iron fittings for sewer force main and lift station shall have an interior coating manufactured by PERMOX CTF, PROTECT 401, Perma-Shield PL Series 431, or approved equal.
- D. Retainer Glands
 1. Mechanical joint restraint shall be incorporated in the design of the follower gland and shall include a restraining mechanism which, when actuated, imparts multiple wedging action against the pipe, increasing its resistance as the pressure increases. Glands shall be manufactured of ductile iron conforming to ASTM A536. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI A21.11 and ANSI/ AWWA C153/ A21.53, latest revision. Twist-off nuts shall be used to insure proper actuating of the restraining devices.
 2. The mechanical joint restraining device shall have a working pressure of at least 250 psi with a minimum safety factor of 2:1, and shall be EBAA Iron, Inc., MEGALUG Series 2000 or 19MJ00, or SIP Industries PTP Restraints (PTPVC), or approved equal.
 3. Push-on joint restraints shall be similar to EBAA Iron, Series 1900 or approved equal.
 4. Coatings: All Mechanical Joint Restraints, for Ductile or PVC Pipe, shall be electrostatically applied and heat cured. The coating shall be a polyester based powder to provide corrosion, impact and UV resistance.

2.5 Detection Tape and Trace Wire

- A. Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tapes shall be color coded in accordance with APWA color codes with the following legends: Sanitary Sewerage Systems, Safety Green, "Caution: Sewer Line Buried Below". Colors may be solid or striped. Tape shall be permanently printed with no surface printing allowed. Tape width shall be minimum 2-inches when buried less than 10-inches below the surface. Tape width shall be minimum 3-inches when buried greater than 10-inches and less than 20-inches. Detection tape shall be Pro-Line Safety Products Detectable Tape 2-inch No:

103111253 3-inch No: 103121253, or approved equal. In addition, the Contractor shall furnish and install 10 gauge coated copper tracing wire shall be Pro-Line HF-CCS-PE30 or Copperhead Superflex 1030, or approved equal

2.6 Anchor Couplings

- A. Lengths and sizes of anchor couplings shall be as shown on the Drawings. Anchor couplings shall be equal to Tyler Pipe 5-198.

2.7 Flange Adapter

- A. The flange adapter shall permit the connection of unthreaded, un-grooved, open-ended ductile iron pipe to ANSI/ASME B16.1, Class 125 flanges. The flange adapter shall meet the test requirements of ANSI/ASME B16.1 for Class 125 flanges. The adapter shall be a ductile iron casting incorporating a flange with extended throat, set screws and gasket. The gasket shall provide a compression seal between the adapter, the pipe and the adjacent flange. Flange adapters shall be used only in locations specifically shown on the Drawings or at the direction of the County, and in accordance with the manufacturer's recommendations. The flange adapter shall be equal to EBAA Iron "Mega Flange". Additionally, flange adapters shall be provided with 304 stainless steel harness rods of the diameter and quantity shown on the Drawings or directed by the County.

2.8 Gate and Tapping Valves

A. General

1. Gate and tapping valves shall be resilient seat and shall comply with all requirements of AWWA C509 and the following supplemental requirements:
2. Valves 12-inches and smaller shall be bubble-tight at 200 psi water working pressure. Test pressure shall be twice the rated working pressure and at all times zero leakage will be maintained.
3. All valves shall be Class B gray iron body, non-rising stem, suitable for buried vertical mounting.
4. Non-rising stems shall be in full compliance with AWWA specifications with cast integral stem collar and furnished of bronze conforming to ASTM B132 Alloy A.
5. Stem nuts shall be independent of wedge and shall be of solid bronze conforming to ASTM B62.
6. Sealing mechanism shall be either a replaceable internally reinforced, specially contoured, molded rubber discs seat ring attached to the face of the disc with self-locking stainless steel screws or a sealing surface permanently bonded with resilient material to meet ASTM D429. Replaceable seat rings

shall be designed such that sealing mechanism cannot be installed improperly.

7. Stuffing boxes shall be O-ring seal type with two rings located in the stem.
 8. Low friction torque reduction thrust bearings shall be located both above and below the stem collar.
 9. All valves shall open by turning a two inch square operating nut counterclockwise.
 10. All valves shall be furnished with operating nuts, unless noted otherwise.
 11. All tapping valves shall have flange-by-mechanical joint ends.
 12. All tapping valves shall be interchangeable with other makes of tapping sleeves.
- B. Joints: Joints shall be mechanical joints and shall conform to AWWA C111, and all bolts and nuts for mechanical joints shall be high-strength, low-alloy steel in accordance with AWWA C111. All gaskets shall be for a standard mechanical joint of BUNA-S (SBR Buna) in accordance with ANSI/ AWWA C111/A21.4. All mechanical joint accessories shall be furnished with the valves.
- C. Coating: Body and cover bolts and nuts shall meet specifications ASTM A307 and be corrosion-proof. Valve interior shall have protective coating meeting AWWA C550.
- D. Approved models are:
1. American Flow Control Series 2500 Resilient Wedge Valve
 2. Muller Company A-2362-78 Resilient Wedge Gate Valve
 3. AVK Resilient Seated Gate Valve

2.9 Tapping Sleeves

- A. Tapping sleeves 3-inch and larger shall have a threaded test port with plug for pressure testing on the tapping sleeves and tapping valve and shall be constructed of stainless steel, and in two halves. All tapping sleeves shall be Romac STS 420, JCM 452, TPS Triple Tap Tapping Sleeves, or approved equal. Bolts in the tapping sleeve shall be stainless steel.

2.10 Tapping Saddles

- A. Tapping saddles shall be constructed of heavy, ductile iron, with the attachment straps, nuts and washers constructed of corrosion resistant alloy steel in

accordance with AWWA C111. All tapping saddles shall be JCM 406, Smith-Blair 317, TPS T-3, or equal.

2.11 Concrete

- A. Concrete shall have a compressive strength of not less than 3,000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. For job mixed concrete, submit the concrete mix design for approval by the County. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM-A 615, Grade 60.

2.12 Plug Valves

- A. Valves shall be 90 degree turn, non-lubricated, and eccentric type with resilient faced plugs. Design of the valve shall provide that contact between the seat and the plug shall only occur in the final degrees of plug movement. Valves shall be suitable for throttling service and service where valve operation is infrequent.
- B. Valves shall provide drip-tight shut-off up to the full pressure rating with pressure in either direction. Pressure ratings shall be established by hydrostatic tests conducted in accordance with ANSI B16.1. Valves shall be rated at a minimum of 150 psi.
- C. Valves shall have a port area equal to at least 80 percent of the full pipe area.
- D. Bodies shall be cast-iron, conforming to ASTM A 126, Class B (carbon steel for 2-inch valves).
- E. Valve ends shall be a mechanical joint type, except where flanged or restrained joint ends are shown on the Drawings. Mechanical joint valves shall have bell ends conforming to applicable requirements of AWWA C111/ANSI A21.11. Flanged joints shall meet the requirements of ANSI B16.1, Class 125. Flanged valves with flange-to-MJ adapters shall not be acceptable in lieu of MJ valves.
- F. Valve seats shall be a raised, welded-in overlay of not less than 90 percent pure nickel, machined to mate with the resilient faced plug. Overlay shall be a minimum of 1/8-inch thick. Seats shall be EPDM rubber seats.
- G. The plug shall be of semi-steel, conforming to ASTM-A 126, Class B. The plug facing shall be a synthetic rubber compound of approximately 70 durometer hardness bonded to the plug. Facing material shall be abrasion resistant and suitable for service in sewage and sludge applications.
- H. Valves shall be furnished with replaceable, sleeve-type bearings in the upper and lower journals. Bearings shall comply with applicable requirements of AWWA C507. Bearing materials shall have a proven record of service of not less than five years.
- I. The valve body shall be fitted with a bolted bonnet incorporating a stuffing box and pull-down packing gland. Packing shall be the split chevron type. Design of exposed valves shall allow visible inspection of the shaft seal, adjustment of the

packing, and replacement of the packing, all without disturbing the bonnet or valve operator. The shaft seal shall comply with the requirements of AWWA C504.

J. Actuators

1. Valves for exposed service, 3 through 8-inches in diameter, shall be lever operated. Hand levers shall be steel with a non-metallic grip.
2. Actuators for buried service and valves 10-inches and larger, shall be equipped with manual operated geared actuators. Geared actuators shall be totally enclosed, oil lubricated, worm and gear type. Geared actuators shall turn in the same direction as non-geared actuators. Shaft seals shall be provided to prevent entry of dirt and water into the actuator. All shaft bearings shall be permanently lubricated bronze bushings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque. Construction of actuator housing shall be semi-steel. Gear actuators shall comply with requirements of AWWA C504.
3. Gear actuators for buried valves 10-inches and larger in diameter shall be mounted above ground on an extended bonnet.
4. Motorized actuators shall be provided where shown on the Drawings and as specified in this Section. Motorized actuators shall be Rotorq, EIM, or AUMA.
5. Valves and operators for submerged or buried service shall have seals on all shafts and gaskets on valve operator covers to prevent the entry of water. Operator mounting brackets for submerged service shall be totally enclosed and shall have gasket seals.

K. Operators

1. Valves for non-buried service, six feet or more above the operating floor shall be furnished with a chainwheel operator and chain for operation from floor level. All other valves shall be equipped with a handwheel operator.
2. Valves, 3 through 8-inches, for buried service shall have a nut type operator and shall be equipped with a valve box and stem extension required to bring the operation nut within 6-inches of finished grade. Valve boxes and extension stems shall be as specified in this Section.

L. All exposed bolts, nuts, and washers for buried or submerged valves shall be stainless steel.

M. The exterior of all buried valves shall have a factory applied, two coat coal tar epoxy coating system. The coal tar epoxy shall be TNEMEC Tneme-Tar 46-413, Indurall Ruffstuff 2100 Coal Tar Epoxy or Kop-Coat Bitumastic No. 300-M. Each coating shall have a minimum dry film thickness of 8-10 mils.

N. All ferrous metal interior surfaces of plug valves shall be provided with a factory applied epoxy interior coating conforming to the requirements of AWWA C550. The

coating shall be either TNEMEC Series 20 Pota Pox, Valspar Series 78 or Kopcoat Hi Gard Epoxy. Each coating shall have a minimum dry film thickness of 4 to 6 mils.

- O. Acceptable Manufacturers: All plug valves shall be products of a single manufacturer who must submit evidence of five years satisfactory service in sewage applications of the same design and of the sizes required. Valves shall be manufactured by DeZurik, Pratt or Val-Matic.

2.13 Air Valves for Sewerage Service

- A. General: Unless specifically approved by the County, combination air valves shall be installed in accordance with these Specifications. In areas of high water table, valve shall be located above ground in insulated boxes.
- B. Air Release Valves: Valves shall be automatic air release valves designed to allow escape of air under pressure and close water-tight when liquid enters the valve. Valve shall have a 1-inch NPT inlet and a maximum orifice diameter of 3/32-inch. The valve body shall be plastic, designed to facilitate disassembly for cleaning and maintenance. The float shall be stainless steel; the valve seat and all working parts shall be of corrosion-resistant materials. Valves shall be equipped with the necessary attachments, including valves, quick disconnect couplings and hose, to permit back flushing after installation without dismantling the valve. ARI or an approved equal shall be used.
- C. Air/Vacuum Valves: Valves shall be automatic air and vacuum valves designed to allow escape of air, close water-tight when liquid enters the valve, and allow air to enter in the event of a vacuum. The valve body shall be plastic, designed to facilitate disassembly for cleaning and maintenance. The float shall be stainless steel; the valve seat and all working parts shall be of corrosion-resistant materials. Valves shall be equipped with the necessary attachments, including valves, quick disconnect couplings and hose, to permit back flushing after installation without dismantling the valve. The valves shall have an orifice diameter of 2-inches and NPT inlet and outlet diameters of 2 x 2-inches. ARI or an approved equal shall be used.
- D. Combination air valve shall consist of an air release valve tapped into the body of an air and vacuum valve.
- E. Single Body Valve: In lieu of D. above, a single body, double orifice, sewage combination valve may be used. Materials of construction, orifice size, venting capacity and accessories shall meet the requirements of B. and C. above.

2.14 Check Valves

- A. Check valves shall be hinged disc type with cast iron body and low zinc bronze or bronze-fitted disc. Valves shall not slam shut on pump shutdown. Valves shall be equipped with a 1/2-inch stop cock at the high point of the valve for bleeding air from the line.

- B. Check valves shall be of the globe design with ANSI 125 pound flanges.
- C. Check valves shall be American Series 2100 Resilient Seated Check Valve, Valvematic "Swingflex" or approved equal.

2.15 Valve Boxes and Extension Stems

A. Valve Boxes

1. Unless shown otherwise on the Drawings, all valves shall be equipped with valve boxes. The valve boxes shall be cast iron two-piece screw type with drop covers. Valve boxes shall have a 5.25-inch inside diameter. Valve box covers shall weigh a minimum of 13 pounds. The valve boxes shall be adjustable to 6-inches up or down from the nominal required cover over the pipe. Valve boxes shall be of sufficient length that bottom flange of the lower belled portion of the box is below the valve operating nut. Ductile or cast iron extensions shall be provided as necessary. Covers shall have "SEWER" cast into them. Valve boxes shall be manufactured in the United States.
2. Valve boxes shall be manufactured by American Flow Control Trench Adapter and Retrofit box insert ("or approved equal").

B. Extension Stems: Extension stems shall always be provided. Connection to the valve shall be with a wrench flush to the nut coupling and a set screw to secure the coupling to the valve's operating nut. The coupling and square wrench nut shall be welded to the extension stem. Extension stems shall be equal to M & H Valve, Style 3801.

1. The extension stem shall be a fully adjustable valve box and extension stem system that is available in trench depths ranging from 3 feet to 20 feet. Both the valve box and the extension stem shall adjust to grade in a matter of seconds, completely eliminating the need to cut extension stems in the field. It shall be able to raise the upper pipe to the proper height and lock it into the new position.
2. The extension stem product that shall be used is an AMERICAN Trench Adapter, or equivalent.

Part 3 Execution

3.1 General

- A. Pipe, fittings, valves and appurtenances shall be installed in accordance with the manufacturer's recommendation and the applicable sections of the codes and standards listed in the quality and assurance section of these specifications.

3.2 Existing Utilities and Obstructions

- A. The Drawings indicate utilities or obstructions that are known to exist according to the best information available to the County. The Contractor shall call the Sunshine State One Call of Florida, Inc. (1-888-761-3042), as required by Florida law and all utilities, agencies or departments that own and/or operate utilities in the vicinity of the construction work site, at least 72 hours (three business days) prior to construction, to verify the location of the existing utilities.
- B. Conflict with Existing Utilities:
1. Horizontal Conflict: Horizontal conflict shall be defined as when the actual horizontal separation between a utility, main, or service and the proposed pressure main does not permit safe installation of the pressure main by the use of sheeting, shoring, supporting, or temporarily suspending service of the parallel or crossing facility. The Contractor may change the proposed alignment of the pressure main to avoid horizontal conflicts if the new alignment remains within the available right-of-way or easement and complies with regulatory agency requirements after a written request to and subsequent approval by the County. If, in the opinion of the County, the pressure main's proposed location cannot be adjusted, thus requiring the relocation of an existing utility, the County will direct the Contractor to relocate the utility as part of the Contract with the costs of such relocation being paid for as part of a change order.
 2. Vertical Conflict: Vertical conflict shall be defined as when the actual vertical separation between a utility, main, or service and the proposed pressure main does not permit the crossing without immediate or potential future damage to the utility, main, service, or the pressure main. The Contractor may change the proposed grade of the pressure main to avoid vertical conflicts if the changed grade provides minimum required capacity, maintains adequate cover and complies with regulatory agencies requirements, after written request to and subsequent approval by the County. If, in the opinion of the County, the pressure main's proposed location cannot be adjusted, thus requiring the relocation of an existing utility, the County will direct the Contractor to relocate the utility as part of the Contract with the costs of such relocation being paid for as part of a change order.
- C. Water and Force Main Separation
1. Force mains should maintain a minimum 10 foot edge-to-edge separation from water mains. Where the sewer crosses a water main, an 18-inch vertical separation shall be maintained where possible. Where possible, a full joint of sewer pipe shall be centered over the water main. Any deviation shall be requested in writing to the County. If ten feet cannot be maintained, refer to Florida Administrative Code 62-555.314, which states that a minimum of six feet is acceptable.

2. Where the force main crosses over a water main, the water main shall be encased in concrete to the first joint in each direction.
3. No water main shall be permitted to pass through or come in contact with any part of a manhole.

3.3 Handling Pipe

- A. General: All material, unless otherwise directed, shall be unloaded at the job site and distributed at the site of the project by the Contractor. Materials shall be handled with care to avoid damage. In loading and unloading, pipe shall be lifted by hoists or slid or rolled on skids in such a manner as to avoid shock. Under no circumstances shall pipe be dropped. Pipe handled on skids must not be allowed to roll against pipe already on the ground. The Contractor shall be responsible for the safe handling of all materials. Damaged materials will be rejected by the County.
- B. Pipe shall be handled so as to avoid damage to the coating and lining. If, however, any part of the coating or lining is damaged by the Contractor, the repair shall be made by the Contractor at his expense in a manner satisfactory to the County before installation.
- C. Pipe shall be distributed on the site of the work parallel with and opposite or near the place it is to be laid in the trench, and with bell ends facing the directions in which the installation will proceed unless otherwise directed.

3.4 Pipe Distribution

- A. Pipe shall be distributed and placed in such a manner that will not interfere with traffic.
- B. No pipe shall be strung further along the route than 1,000 feet beyond the area in which the Contractor is actually working without written permission from the County. The County reserves the right to reduce this distance to a maximum distance of 200 feet in residential and commercial areas based on the effects of the distribution to the adjacent property owners.
- C. No street or roadway may be closed for unloading of pipe without first obtaining permission from the proper authorities. The Contractor shall furnish and maintain proper warning signs and obstruction lights for the protection of traffic along highways, streets and roadways upon which pipe is distributed.
- D. No distributed pipe shall be placed inside drainage ditches.
- E. Distributed pipe shall be placed as far as possible from the roadway pavement, but no closer than five feet from the roadway pavement, as measured edge-to-edge.
- F. No pipe shall be dropped or rolled off from the truck. Pipe that has been dropped or rolled from the truck will be considered damaged and will not be used.

3.5 Installation of Pipe

A. General

1. Upon satisfactory installation of the pipe bedding, as specified in the "Earthwork for Utilities" section of these specifications, a continuous trough for the pipe barrel and recesses for the pipe joints shall be excavated by hand digging so that when the pipe is laid in the trench true to line and grade, the pipe barrel will receive continuous uniform support and the joint will receive no pressure from the trench bottom.
2. The interior of all pipe shall be thoroughly cleaned of all foreign material before being lowered into the trench and shall be kept clean during laying operations by means of plugs or other approved methods.
3. All pipe, fittings, and valves shall be carefully lowered into the trench by means of derrick, ropes or other suitable tools or equipment, in such a manner as to prevent damage to pipe coatings, and lining. Under no circumstances shall pipe or accessories be dropped, dumped or rolled into the trench from finished ground level.
4. The gasket material for the joint shall be properly positioned before the pipe is lowered into the trench. The joining of the pipe shall proceed in accordance with the manufacturer's recommendations.
5. Watertight plugs shall be installed in open ends of the pipe at all times when pipe laying is not in progress. At no time shall trench water be permitted to enter pipe.
6. Cutting of pipe for inserting valves, fittings or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe. Wherever it is necessary to cut gray or ductile cast iron pipe which is equipped with a push-on joint type bell end, the cut end of the pipe shall be adequately beveled so as to prevent the edge of the cut pipe from cutting or tearing the gasket as the plain end is inserted into the bell of the adjoining pipe or fitting. All field-cut pipe shall be beveled by the Contractor and the pipe "short" shall be used as part of the pipeline construction.
7. Whenever necessary to deflect pipe after proper homing from a straight line, either in the vertical or horizontal plane to avoid obstructions, the maximum allowable deflection shall be in accordance with the pipe manufacturer's recommendations. Only after the pipe has been properly homed will it be allowed to deflect.
8. No pipe shall be laid in water or when the trench conditions or the weather is unsuitable for such work.
9. All sewer Force Mains shall be located a minimum of 30 inches below grade and 36 inches below top of pavement. Any pipe which is disturbed or found to be defective after laying shall be removed and relayed or replaced.

10. Prior to connecting new work to existing lines or appurtenances, the Contractor shall verify location and elevation of existing connection point and notify County of any conflicts or discrepancies.

B. Joints(DIP)

1. Before laying the pipe, all lumps, blisters, and excess coal tar coating shall be removed from the bell and plain ends of each length of pipe. The pipe ends shall then be wire brushed and wiped until clean and dry. Where mechanical joints or push-on joints are specified, oil and grease also shall be removed. Pipe ends shall be kept clean until joints are made. The plain end of pipe for mechanical joints shall be lubricated with a soapy solution before installing the gaskets.
2. In making up the push-on type joint, the gasket shall be placed in the socket per manufacturer's recommendation. A thin film of lubricant (approved by the pipe manufacturer) shall then be applied to the inside surface of the gasket that will come in contact with the entering pipe. The plain end of the pipe to be entered shall be thoroughly cleaned and placed in alignment with the bell of the pipe to which it is to be joined. The joint shall be made by exerting sufficient force on the entering pipe so that the plain end is moved past the gasket until it seats as per manufacturer's recommendation.
3. Backhoe buckets or excavation equipment are not to be applied directly to the pipe.
4. Mechanical joints shall be assembled in accordance with AWWA Standards. Mechanical joints shall be centered in the bells. Soapy water shall be brushed over the gasket just prior to installation. The gasket and gland shall be placed in position, the bolts inserted, and the nuts tightened by hand.
5. The bolts shall be tightened on opposite sides of the pipes by means of a torque wrench in such a manner that the gland shall be brought up evenly into the joint. The following range of bolt torques shall be applied:

<u>Bolt Size (Inches)</u>	<u>Range of Torque</u>
¾-inch Diameter	85 to 95 ft.-lbs.
1-inch Diameter	95 to 100 ft.-lbs.
6. If effective seal is not obtained at a maximum torque listed above, the joint shall be disassembled and reassembled after thorough cleaning.
7. If a joint is defective, it shall be cut out and entirely replaced or, if approved by the County, it may be repaired by a suitable clamp.

3.6 Installation of Fittings

- A. Fittings shall be handled with care to avoid damage. All fittings shall be loaded and unloaded by lifting, and under no circumstances shall fittings be dropped, skidded, or rolled. Under no circumstances shall fittings be placed against pipe or other

fittings in such a manner that damage could result. Slings, hooks, or tongs used for lifting shall be padded in such a manner as to prevent damage to exterior surface or interior lining of fittings. If any part of the fittings' coating or lining is damaged by the Contractor, the repair or replacement shall be made by the Contractor at his expense and in a manner satisfactory to the County before installing. Fittings shall also be stored at all times in a safe manner to prevent damage and kept free of dirt, mud, or other foreign matter. All fitting gaskets shall be stored and placed in a cool location out of direct sunlight and out of contact with petroleum products. All gaskets shall be used on a first-in, first-out basis.

- B. Fittings shall be set and joined to the pipe in a manner specified previously for joint assembly. When conditions warrant, fittings should be provided with special support trussing and blocking.

3.7 Anchorage of Bends, Tees and Plugs

- A. General: Adequate precautions shall be taken to prevent the separation of joints at bends, tees and plugged ends.
- B. Retainer glands shall be installed in accordance with manufacturer's recommendations.
- C. Thrust Blocking
 - 1. Where reaction or thrust blocking is required, it shall be of concrete of a mix not leaner than one cement, two and one-half sand, five stone, having a compressive strength of not less than 3,000 pounds per square inch after 28 days and shall have a minimum curing time of three days. The poured concrete shall be left exposed for a minimum of 24 hours before backfilling, but not more than 48 hours. Before concrete thrust blocks are covered, Contractor will have the County inspect the installation. Concrete thrust blocking shall not cover bolts or prevent access in such a way to prevent bolt removal or effect repair.
 - 2. Blocking shall be placed between undisturbed earth and the fitting to be anchored; the area of bearing on pipe and on ground in each instance shall be that shown in the Construction Details. The blocking shall, unless otherwise directed, be so placed that the pipe and fitting joints will be accessible for repair.
 - 3. Concrete shall not cover pipe or bolts.

3.8 Installation of Valves

- A. Resilient seat gate valves shall be located no more than 500 feet apart in commercial, industrial and high-density residential areas and no more than 1000 feet in all other areas. Valves shall be spaced to isolate a maximum of 40 single-family residential lots. A minimum of two valves per tee, and three valves per 4-way cross, shall be required to isolate and maintain adequate service. Valves shall be

placed at branch lines and located at the end of all water main extensions except at looped cul-de-sacs.

- B. General: Valves shall be handled with care to avoid damage. All valves shall be loaded and unloaded by lifting, and under no circumstances shall valves be dropped, skidded or rolled. Valves shall not be placed, under any circumstances, against pipe or other fittings in such a manner that damage could result. Slings, hooks or tongs used for lifting shall be padded in such a manner as to prevent damage. If any part of the valve coating and lining is damaged by the Contractor, the repair or replacement shall be made by the Contractor at his expense in a manner satisfactory to the County before installing. Valves shall also be stored at all times in a safe manner to prevent damage and kept free of dirt, mud or other foreign matter. All valve gaskets shall be stored and placed in a cool location out of direct sunlight and out of contact with petroleum products. All gaskets shall be used on a first-in, first-out basis.
- C. Gate valves shall be set and joined to new pipe in the manner previously specified for cleaning, laying and joining pipe.
- D. Valve Boxes: Cast iron valve boxes shall be firmly supported and maintained centered and plumb over the operating nut of the valve by the Contractor with box cover flush with the surface of the finished pavement or at such other level as may be directed. All valve boxes set in non-paved areas shall have concrete pads poured around the top section of the valve box. The pad shall be a 24 inch square pad and shall be centered on the valve box. All sewer valve covers shall be painted safety green as defined by the American Public Works Association (APWA) uniform color code for utility systems. All valve covers shall be cast with the word SEWER. A welder shall burn the number of turns to open/close the valve, into the cover.
- E. The Contractor shall provide a Carsonite Utility Markers or approved equivalent with U.V. resistant decal for each valve installed. Valve decal shall be stamped "CAUTION SEWAGE VALVE".

3.9 Installation of Taps

- A. General: All drilling and tapping equipment used and material supplied to make taps will be in accordance with AWWA Standards.
- B. After the tapping sleeve and valve have been installed and before the tap is made, the sleeve will be tested to ensure a watertight joint. A test plug will be provided in the sleeve and after the sleeve has been installed it will be filled with water and the pressure increased between 150 psi and 190 psi. All leaking joints will be repaired to the satisfaction of the County at the Contractor's expense.
- C. All pipe coupons removed as a result of taps to any pipeline shall be retained for presentation to the County.

3.10 Detection Tape and Trace Wire

- A. Provide detection tape and trace wire for all water mains.
- B. Detection tape shall be located 18-inches above the crown of the pipe.
- C. Trace wire shall not be wrapped around the pipe.
- D. Trace wire shall be laid parallel to the 12 o'clock position of the main with at least 6-inches of separation.
- E. Trace wire shall be looped into each valve box and pulled out a minimum of two feet from the top of the valve box.

3.11 Testing and Inspection Requirements

- A. The Contractor shall coordinate all testing and inspections with the Owner. The Contractor shall notify the County and applicable agency inspectors 48 hours in advance of testing and inspections.

3.12 Hydrostatic Test

- A. Hydrostatic Test: A hydrostatic test shall be performed on all mains and fittings for a minimum of two hours at 100 psi in accordance with AWWA Manual of Water Supply Practices M23. Test shall occur at any convenient time upon backfill of lines and after all piping has been thoroughly cleaned and flushed to clear the lines of all foreign matter. Prior to test, allow adequate curing time for reaction blocking.
- B. Gages and Recorders: The Contractor shall, upon request of the County, furnish certified test data for pressure gauges and recorders used on hydrostatic test equipment. At the option of the County, flow meters and/ or pressure gauges used for hydrostatic testing shall be equipped by the Contractor with approved strip or round chart recorders. Tests shall be made in sections not exceeding one-half mile.
- C. Each valved section of pipe to be tested shall be slowly filled with water and a test pump shall be installed at the low point of the section being tested. All air in the line will be expelled before applying specified test pressure. To accomplish this, taps will be made, if necessary, at the point of highest elevation and afterward tightly stopped with tapered brass plugs, all at the Contractor's expense.
- D. After installation and filling of the line as specified, the Contractor will pump the line to a pressure greater than 100 psi. At no time shall the test or line pressure exceed 140 psi. If required by the County, pump test equipment shall be equipped with pressure relief valves pre-set to 140 psi.
- E. Throughout the duration of the test, the Contractor is required to maintain a minimum pressure in excess of 100 psi. The Contractor is advised that, should the line pressure fall to or below 100 psi at any time during the two hour test, the test will be considered invalid and a retest in accordance with this procedure will be

required. Therefore, it is advisable to pump water into the line as the line pressure approaches 100 psi. The test will be conducted with a pressure variation of not more than 5 psi for the duration of the test.

- F. At the end of the two hour test period, the Contractor will be required to pump the pipe lines back up to the highest pressure obtained during the duration of the test period. If chart records are required for the hydrostatic test, the Contractor shall furnish flow and/ or pressure charts as a condition of concluding the test.
- G. The allowable leakage, as specified below, will be defined as any volume of water required to maintain a minimum pressure in excess of 100 psi during the duration of the test period plus that volume of water required at the conclusion of the test to bring the line pressure back up to the highest pressure obtained during the duration of the test period.

Two Hour Hydrostatic Test Allowable Leakage (Gallons) for 100 LF or 5 Joints Allowable Leakage for AWWA PVC Pipe

Nominal pipe size (in.)	Average Test Pressure/Leakage (Gallons)	
	100 PSI	150 PSI
4"	0.027	0.033
6"	0.041	0.050
8"	0.054	0.066
10"	0.068	0.083
12"	0.081	0.099

- H. Leakage detection at mechanical joints shall be stopped by tightening the gland (not to exceed required torque) and leaking at slip joints shall be cut out and entirely replaced or, if approved by the County, it may be repaired by a suitable clamp. Any cracked or defective pipes, fittings or valves discovered as a result of this pressure test shall be removed and replaced by the Contractor with sound material and the test shall then be repeated until satisfactory.
- I. The Contractor is warned that pressure testing against existing "end-of-line" valves is done at his own risk. Failure of these valves to hold test pressure will not relieve the Contractor of the pressure testing nor will it entitle him to any additional compensation for the extra work performed.

END OF SECTION

Part 1 General

1.1 General Description:

- A. The manufacturer shall furnish complete a factory-built and tested grinder pump unit, consisting of a grinder pump core all suitably mounted on an integral stand of stainless steel, special polyethylene tank, electrical quick disconnect (NEMA 6P), pump removal harness, discharge assembly/shut-off valve, anti-siphon valve/check valve assembly, electrical alarm assembly and all necessary internal wiring and controls. For ease of serviceability, all pump motor/grinder units shall be of like type and horsepower throughout the system.

1.2 Submittals:

- A. The manufacturer shall furnish a minimum of six sets of shop drawings detailing the equipment to be furnished including dimensional data and materials of construction. Following the engineer's review of this data, engineer will return two copies as accepted, or with requested modifications. Upon receipt of accepted shop drawings, the manufacturer shall proceed immediately with fabrication of the equipment.

1.3 Manufacturer:

- A. Grinder pump stations, complete with all appurtenances, form an integral system, and as such, shall be supplied by one grinder pump station manufacturer. The contractor shall be responsible for the satisfactory operation of the entire system. The equipment specified shall be a product of a company experienced in the design and manufacture of grinder pumps for specific use in low pressure sewage systems. The company shall submit detailed installation and user instructions for its product, submit evidence of an established service program including complete parts and service manuals, and be responsible for maintaining a continuing inventory of grinder pump replacement parts. The manufacturer shall provide, upon request, a reference and contact list from ten of its largest contiguous grinder pump installations of the type of grinder pumps described within this specification.

The MANUFACTURER of the grinder pump station shall be Environment One Corporation model WH484-110, or equal.

1.4 Experience Clause:

- A. All manufacturers proposing equipment for this project shall have at least 10 years of experience in the design and manufacture of units of identical size(s) and performance to the specified units. All manufacturers proposing equipment for this project must also have not less than 500 successful installations utilizing grinder pumps of like type to the grinder pumps specified herein.

1.5 Operating Conditions:

- A. A single pump shall be capable of delivering 15 gpm against a rated total dynamic head of 0 feet (0 psig), 11 gpm against a rated total dynamic head of 92 feet (40 psig), and 7.8 gpm against a rated total dynamic head of 185 feet (80 psig). The pumps must also be capable of operating at negative total dynamic head without overloading the motors. Under no conditions shall in-line piping or valving be allowed to create a false apparent head.

1.6 Warranty:

- A. The grinder pump manufacturer shall provide a part(s) and labor warranty on the complete station and accessories, including, but not limited to, the panel for a period of 24 months after notice of owner's acceptance, but no greater than 27 months after receipt of shipment. Any manufacturing defects found during the warranty period will be reported to the manufacturer by the owner and will be corrected by the manufacturer at no cost to the owner.

1.7 Warranty Performance Certification:

- A. A warranty performance certification statement executed by the most senior executive officer of the grinder pump manufacturer shall be submitted, which certifies a minimum of a 24-month warranty. They must further detail any exclusions from the warranty or additional cost items required to maintain the equipment in warrantable condition, including all associated labor and shipping fees, and certify that the manufacturer will bear all costs to correct any original equipment deficiency for the effective period of the warranty. All preventive maintenance type requirements shall be included in this form as exclusions. These requirements include, but are not limited to, unjamming of grinder mechanism, periodic motor maintenance, and periodic cleaning of liquid level controls. Should the contractor (supplier) elect to submit a performance bond in lieu of the experience clause outlined above, this warranty performance certification shall also be used as a criterion to evaluate the contractor's (supplier's) performance over the warranty period. A warranty performance certification form is included with the bid schedule and must be completed and submitted as part of the bid package. Bids with incomplete forms or missing forms will be considered nonresponsive.

Part 2 Product

2.1 Pump:

- A. The pump shall be a custom designed, integral, vertical rotor, motor driven, solids handling pump of the progressing cavity type with a single mechanical seal. Double radial o-ring seals are required at all casting joints to minimize corrosion and create a protective barrier. All pump castings shall be cast iron, fully epoxy coated to 8-10 mil nominal dry thickness, wet applied. The rotor shall be through-hardened, highly polished, precipitation hardened stainless steel. The stator shall be of a specifically compounded ethylene propylene synthetic elastomer. This material shall be suitable

for domestic wastewater service. Its physical properties shall include high tear and abrasion resistance, grease resistance, water and detergent resistance, temperature stability, excellent aging properties, and outstanding wear resistance. Buna-N is not acceptable as a stator material because it does not exhibit the properties as outlined above and required for wastewater service.

2.2 Grinder:

- A. The grinder shall be placed immediately below the pumping elements and shall be direct-driven by a single, one-piece motor shaft. The grinder impeller (cutter wheel) assembly shall be securely fastened to the pump motor shaft by means of a threaded connection attaching the grinder impeller to the motor shaft. Attachment by means of pins or keys will not be acceptable. The grinder impeller shall be a one-piece, 4140 cutter wheel of the rotating type with inductively hardened cutter teeth. The cutter teeth shall be inductively hardened to rockwell 50 – 60c for abrasion resistance. The shredder ring shall be of the stationary type and the material shall be white cast iron. The teeth shall be ground into the material to achieve effective grinding. The shredder ring shall have a staggered tooth pattern with only one edge engaged at a time, maximizing the cutting torque. These materials have been chosen for their capacity to perform in the intended environment as they are materials with wear and corrosive resistant properties.

This assembly shall be dynamically balanced and operate without objectionable noise or vibration over the entire range of recommended operating pressures. The grinder shall be constructed so as to minimize clogging and jamming under all normal operating conditions including starting. Sufficient vortex action shall be created to scour the tank free of deposits or sludge banks which would impair the operation of the pump. These requirements shall be accomplished by the following, in conjunction with the pump:

1. The grinder shall be positioned in such a way that solids are fed in an upward flow direction.
2. The maximum flow rate through the cutting mechanism must not exceed 4 feet per second. This is a critical design element to minimize jamming and as such must be adhered to.
3. The inlet shroud shall have a diameter of no less than 5 inches. Inlet shrouds that are less than 5 inches in diameter will not be accepted due to their inability to maintain the specified 4 feet per second maximum inlet velocity which by design prevents unnecessary jamming of the cutter mechanism and minimizes blinding of the pump by large objects that block the inlet shroud.
4. The impeller mechanism must rotate at a nominal speed of no greater than 1800 rpm.

The grinder shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of “foreign objects,” such as paper, wood, plastic, glass, wipes, rubber and the like, to finely-divided particles which will pass

freely through the passages of the pump and the 1-1/4" diameter stainless steel discharge piping.

2.3 Electric Motor:

- A. As a maximum, the motor shall be a 1 hp, 1725 rpm, 240 volt 60 hertz, 1 phase, capacitor start, ball bearing, air-cooled induction type with class F insulation, low starting current not to exceed 30 amperes and high starting torque of 8.4 foot pounds. The motor shall be press-fit into the casting for better heat transfer and longer winding life. Inherent protection against running overloads or locked rotor conditions for the pump motor shall be provided by the use of an automatic-reset, integral thermal overload protector incorporated into the motor. The motor protector shall be specifically investigated and listed by underwriters laboratories inc. For the application. Non-capacitor start motors or permanent split capacitor motors will not be accepted because of their reduced starting torque and consequent diminished grinding capability. The wet portion of the motor armature must be 300 series stainless steel. To reduce the potential of environmental concerns, the expense of handling and disposing of oil, and the associated maintenance costs, oil-filled motors will not be accepted. Pump operation during instances of potentially damaging high current or low voltage conditions shall be inhibited by an in-pump electrical monitoring system that has been investigated and listed by underwriters laboratories inc. For the application. Motor start shall be controlled by a dc driven electromechanical relay integrated within the control compartment of the pump. Electrical monitoring shall ensure the relay operates reliably. AC mechanical contactors for motor start are susceptible to damage from short cycling and will not be accepted.

2.4 Mechanical Seal:

- A. The pump/core shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump. The seal shall have a stationary ceramic seat and carbon rotating surface with faces precision lapped and held in position by a stainless steel spring.

2.5 Tank: Polyethylene Construction.

- A. The tank shall be made of rotational molded polyethylene with high environmental stress cracking resistance. All seams created during tank construction are to be factory tested for leak tightness. The tank wall and bottom must withstand the pressure exerted by saturated soil loading at maximum burial depth. All station components must function normally when exposed to 150 percent of the maximum external soil and hydrostatic pressure.

The overall basin capacity shall be 486 gallons. The basin shall incorporate a tapered bottom with an inside diameter of no greater than 46 inches, reducing to a diameter of no greater than 42 inches to minimize the retained volume. The largest diameter must be no less than 50 inches and no greater than 52 inches.

Taller stations shall have a fiberglass accessway with a hinged, aluminum cover. The accessway shall be an extension of the wetwell assembly and shall include a lockable cover assembly, with vent, providing low profile mounting. The cover shall be aluminum, with a load rating of 300 pounds per square foot. The cover shall have an outside diameter of no greater than 50 inches. Accessway design and construction shall enable field extension of station height in 6-inch increments without the use of any adhesives or sealants requiring cure time before installation can be completed. The accessway wall must withstand the pressure exerted by saturated soil loading at maximum burial depth and must function normally when exposed to 150 percent of the maximum external soil and hydrostatic pressure.

The tank and factory penetrations shall be factory tested and guaranteed to be watertight.

The tank shall be furnished with one EPDM grommet fitting to accept a 4.50" OD DWV or Schedule 40 pipe. Tank dimensions shall be as shown on the contract drawings.

The discharge bulkheads (manifolds) shall be factory installed and warranted by the manufacturer to be watertight. The following provides a description and orientation of the discharge bulkhead(s) for each station type:

QUADPLEX STATION – The tank shall have two stainless steel duplex discharge manifolds, each terminating outside the tank wall with a 1-1/4" female NPT pipe thread and located 180 degrees from each other.

2.6 Discharge Hose and Disconnect/Valve:

- A. All discharge fittings and piping shall be constructed of polypropylene, EPDM or PVC. The discharge hose assembly shall include a shut-off valve rated for 200 psi WOG and a quick disconnect feature to simplify installation and pump removal. The bulkhead penetration shall be factory installed and warranted by the manufacturer to be watertight.

2.7 Electrical Quick Disconnect:

- A. The grinder pump core shall include a factory-installed NEMA 6p electrical quick disconnect (EQD) for all power and control functions. The EQD will be supplied with 32' total, 25' of useable, electrical supply cable (ESC) to connect to the alarm panel. The EQD shall require no tools for assembly, seal against water before the electrical connection is made, and include radial seals to assure a watertight seal regardless of tightening torque. Plug-type connections of the power cable onto the pump housing will not be acceptable due to the potential for leaks and electrical shorts. Junction boxes are not acceptable due to the large number of potential leak points. The EQD shall be so designed to be conducive to field wiring as required.

2.8 Check valve:

- A. The pump discharge shall be equipped with a factory installed, gravity operated, flapper-type integral check valve built into the discharge piping. The check valve will provide a full-ported passageway when open, and shall introduce a friction loss of less than 6 inches of water at maximum rated flow. Moving parts will be made of a 300 series stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A nonmetallic hinge shall be an integral part of the flapper assembly providing a maximum degree of freedom to assure seating even at a very low back-pressure. The valve body shall be an injection molded part made of an engineered thermoplastic resin. The valve shall be rated for continuous operating pressure of 235 psi. Ball-type check valves are unacceptable due to their limited sealing capacity in slurry applications.

2.9 Anti-Siphon Valve:

- A. The pump discharge shall be equipped with a factory-installed, gravity-operated, flapper-type integral anti-siphon valve built into the discharge piping. Moving parts will be made of 300 series stainless steel and fabric-reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A nonmetallic hinge shall be an integral part of the flapper assembly, providing a maximum degree of freedom to ensure proper operation even at a very low pressure. The valve body shall be injection-molded from an engineered thermoplastic resin. Holes or ports in the discharge piping are not acceptable anti-siphon devices due to their tendency to clog from the solids in the slurry being pumped. The anti-siphon port diameter shall be no less than 60% of the inside diameter of the pump discharge piping.

2.10 Core Unit:

- A. The grinder pump station shall have an easily removable core assembly containing pump, motor, grinder, all motor controls, check valve, anti-siphon valve, electrical quick disconnect and wiring. The watertight integrity of the core unit shall be established by a 100% factory test at a minimum of 5 psig.

2.11 Controls:

- A. All necessary motor starting controls shall be located in the cast iron enclosure of the core unit secured by stainless steel fasteners. Locating motor starting controls in a plastic enclosure is not acceptable. Wastewater level sensing controls shall be housed in a separate enclosure from motor starting controls. Level sensor housing must be sealed via a radial type seal; solvents or glues are not acceptable. Level sensing control housing must be integrally attached to pump assembly so that it may be removed from the station with the pump and in such a way as to minimize the potential for the accumulation of grease and debris accumulation, etc. Level sensing housing must be a high-impact thermoplastic copolymer over-molded with a thermo plastic elastomer. The use of PVC for the level sensing housing is not acceptable.

Non-fouling wastewater level controls for controlling pump operation shall be accomplished by monitoring the pressure changes in an integral air column connected to a pressure switch. The air column shall be integrally molded from a thermoplastic elastomer suitable for use in wastewater and with excellent impact resistance. The air column shall have only a single connection between the water level being monitored and the pressure switch. Any connections are to be sealed radially with redundant O-rings. The level detection device shall have no moving parts in direct contact with the wastewater and shall be integral to the pump core assembly in a single, readily-exchanged unit. Depressing the push to run button must operate the pump even with the level sensor housing removed from the pump.

All fasteners throughout the assembly shall be 300 Series stainless steel. High-level sensing will be accomplished in the manner detailed above by a separate air column sensor and pressure switch of the same type. Closure of the high-level sensing device will energize an alarm circuit as well as a redundant pump-on circuit. For increased reliability, pump ON/OFF and high-level alarm functions shall not be controlled by the same switch. To assure reliable operation of the pressure switches, each core shall be equipped with a factory installed equalizer diaphragm that compensates for any atmospheric pressure or temperature changes. Tube or piping runs outside of the station tank or into tank-mounted junction boxes providing pressure switch equalization will not be permitted due to their susceptibility to condensation, kinking, pinching, and insect infestation. The grinder pump will be furnished with a 6 conductor 14 gauge, type SJOW cable, pre-wired and watertight to meet UL requirements with a FACTORY INSTALLED NEMA 6P EQD half attached to it.

2.12 Stainless Steel Curb Stop/Check Valve Assembly (Uni-Lateral):

- A. The curb stop shall be pressure-tight in both directions. The ball valve actuator shall include position stop features at the fully opened and closed positions. The curb stop/check valve assembly shall be designed to withstand a working pressure of 235 psi.

The stainless steel check valve shall be integral with the curb stop valve. The check valve will provide a full-ported 2" passageway and shall introduce minimal friction loss at maximum rated flow. The flapper hinge design shall provide a maximum degree of freedom and ensure seating at low back pressure.

Engineered Thermoplastic Fittings – All plastic fitting components are to be in compliance with applicable ASTM standards.

All pipe connections shall be made using compression fitting connections including a Buna-N O-ring for sealing to the outside diameter of the pipe. A split-collet locking device shall be integrated into all pipe connection fittings to securely restrain the pipe from hydraulic pressure and external loading caused by shifting and settling.

Factory Test – The stainless steel, combination curb stop/check valve component shall be 100 percent hydrostatically tested to 150 psi in the factory.

Construction Practices – Pipe shall be stored on clean, level ground to prevent undue scratching or gouging of the pipe. If the pipe must be stacked for storage, such stacking should be in accordance with the pipe manufacturer's recommendations. The pipe should be handled in such a manner that it is not damaged by being dragged over sharp objects or cut by chokers or lifting equipment.

Segments of pipe having cuts or gouges in excess of 10 percent of the wall thickness of the pipe shall be cut out and removed. The undamaged portions of the pipe shall be rejoined using the butt fusion joining method. Sections of polyethylene pipe should be joined into continuous lengths on the job site above ground. The joining method shall be the butt-fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt-fusion equipment used in the joining procedure shall be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, fusion temperature, alignment, and fusion pressure.

Fused segments of pipe shall be handled so as to avoid damage to the pipe. When lifting fused sections of pipe, chains or cable-type chokers should be avoided. Nylon slings are preferred. Spreader bars should be used when lifting long, fused sections. Care should be exercised to avoid cutting or gouging the pipe.

Installation – Assemble the compression fittings according to the fitting manufacturer's recommendations.

The trench and trench bottom should be constructed in accordance with ASTM D 2321. Embedment materials should be Class I, Class II or Class III materials as defined in ASTM D 2321. The use of Class IV and/or Class V materials for embedment is not recommended and should be allowed only with the approval of the SPECIFYING ENGINEER. Bedding of the pipe should be performed in accordance with ASTM D 2321. Compaction should be as specified in ASTM D 2321. Deviations from the specified compaction shall be approved by the SPECIFYING ENGINEER.

Haunching and initial backfill should be as specified in ASTM D 2321 using Class I, Class II or Class III materials. Materials used and compaction shall be as specified by the SPECIFYING ENGINEER. In cases where a compaction of 85 percent Standard Proctor Density is not attainable, the SPECIFYING ENGINEER may wish to increase the SDR of the pipe to provide adequate stiffness. ASTM D 2321 sections titled "Minimum Cover for Load Application," "Use of Compaction Equipment" and "Removal of Trench Protection" should apply unless directed otherwise by the SPECIFYING ENGINEER.

2.13 Quadplex Protect Plus Alarm Panel:

- A. The QUADPLEX grinder pump station shall include two duplex NEMA 4X, UL-listed alarm panels as described below.

The NEMA 4X enclosure shall be manufactured of thermoplastic to ensure corrosion resistance and suitable for wall or pole mounting. The enclosure shall include a hinged, lockable cover with padlock, preventing access to electrical components, and creating a secured safety front to allow access only to authorized personnel. The standard enclosure shall not exceed 12.5" W x 16" H x 7.5" D.

The panel shall contain one 15-amp single pole circuit breaker for the alarm circuit and one 15-amp double pole circuit breaker per core for the power circuit. The panel shall contain a push-to-run feature, an internal run indicator, and a complete alarm circuit. All circuit boards in the alarm panel are to be protected with a conformal coating on both sides and the AC power circuit shall include an auto resetting fuse.

The visual alarm lamp shall be inside a red, oblong lens at least 3.75" L x 2.38" W x 1.5" H. Visual alarm shall be mounted to the top of the enclosure in such a manner as to maintain NEMA 4X rating. The audible alarm shall be externally mounted on the bottom of the enclosure, capable of 93 dB @ 2 feet. The audible alarm shall be capable of being deactivated by depressing a push-type switch that is encapsulated in a weatherproof silicone boot and mounted on the bottom of the enclosure (push-to-silence button).

The high-level alarm system shall operate as follows:

1. The panel will go into alarm mode if either pump's alarm switch closes. During the initial alarm mode both pumps will run and the alarm light and buzzer will be delayed for a period of time based on user settings (default is 3-1/2 minutes). If the station is still in high-level alarm after the delay, the light and buzzer will be activated.
2. The audible alarm may be silenced by means of the externally mounted push-to-silence button.
3. The visual alarm remains illuminated until the sewage level in the wet well drops below the "off" setting of the alarm switch for both pumps.

The entire alarm panel, as manufactured and including any of the following options shall be listed by Underwriters Laboratories, Inc.

Contains the following features:

4. Alarm Activated Dry Contacts – Normally open relay contact closes upon alarm activation.
5. Alarm Activated Contacts for Remote Indoor Alarm Module – Will work with or without power to the alarm panel
6. Includes Inner Door Dead Front
7. Separate LED's for each condition

Protection features:

8. Low Voltage (Brownout) Protection – A lockout cycle will prevent the motor from operating and will illuminate the Trouble LED if:
 - a. the incoming AC Mains voltage drops below a predetermined minimum, typically 12% of nameplate (211 volts for a 240 volt system) for 2 to 3 seconds, regardless of whether the motor is running
 - b. the lockout cycle will end if the incoming AC Mains voltage returns to a predetermined value, typically 10% of nameplate (216 volts for a 240 volt system).
9. The system continues to retest the voltage every second indefinitely. If the lockout cycle has been initiated and the voltage comes back above the predetermined starting voltage, the system will function normally. The Trouble LED remains illuminated during a Brownout condition and a corresponding Brownout message will be displayed on the LCD screen. The LED will turn off when the Brownout condition ends and the LCD message remains latched until the panel is reset. The audible and visual alarm will not be activated unless there is a high wastewater level in the tank.
10. Run Dry Protection – A 20-minute lockout cycle will prevent the motor from operating and will illuminate the Trouble LED when the wastewater level in the tank is below the pump inlet shroud. A corresponding Run Dry message will be displayed on the LCD screen. The condition is rechecked every 20 minutes and the LCD message remains latched. If the condition is satisfied, the pump is allowed to cycle normally and the Trouble LED will go out, but the LCD message remains latched. The LCD message will remain latched until the panel is reset. If the condition is not satisfied after 3 consecutive attempts, the visual alarm will be activated until the panel is reset or until there is one cycle of normal operation. If a high level condition is presented at any time, a pump run cycle will be activated.
11. High System Pressure Protection – A 20-minute lockout cycle will prevent the motor from operating and will illuminate the Trouble LED when the pressure in the discharge line is atypically high (closed valve or abnormal line plug). A corresponding Overpressure message will be displayed on the LCD screen. The condition is rechecked every 20 minutes. If the condition is satisfied, the pump is allowed to cycle normally and the Trouble LED will turn off, but the LCD message remains latched. The LCD message will remain latched until the panel is reset. If the condition is not satisfied after 3 consecutive attempts, the pump is locked out indefinitely and the audible and visual alarm will be activated. The LCD message and alarms will remain latched until the condition is removed and the panel is reset.

In all of the above cases, if more than one error condition is presented, the LCD message depicting the most recent error condition will be displayed.

2.14 Protect Plus Features:

1. High/Low Voltage monitoring with Trouble indication
2. High/Low Wattage (wattage is used instead of current because it is a better indicator of pump performance) monitoring with Trouble indication
3. Extended Run Time monitoring with Trouble indication
4. Cycle/Event Counter
5. Run Time Counter (Hour Meter)
6. Run Time Limit — time adjustable, user-selected options: 10 minutes (default) to 120 minutes in 1-minute intervals
7. Power-up Delay — time adjustable, user-selected options: None (default), to 300 minutes in 1-minute intervals
8. Alarm Delay — time adjustable, user-selected options: zero to 10 minutes in 30-second increments; 4 minutes is default
9. System self-test diagnostic
10. User-selectable Alarm latch
11. User-selectable Protect Mode disable
12. User-selectable buzzer timer
13. Ready LED to indicate AC power to the station is satisfactory
14. Pump Run LED to indicate pump is operating (LCD indicates which pump is running)
15. Trouble LED indicator and predictive Visual Alarm notification (“blinking” alarm lamp; clears on Normal cycle)
16. High Level Alarm LED indicator (LCD indicates which pump is in alarm)
17. Manual Run switch to manually activate pumps
18. Lead/Lag indication (LCD indicates which pump is lead)
19. Menu-driven programmable controller with navigation overlay-type buttons (Enter, Scroll, Up, Down)
20. Normal Operation LED and Mode button for Mode status

21. Pump Performance menu LED with LCD display of the following pump performance statistics:
 - a. Real-time Voltage
 - b. Real-time Amperage
 - c. Real-time Wattage
 - d. Minimum/Maximum/Average Voltage
 - e. Minimum/Maximum/Average Amperage
 - f. Minimum/Maximum/Average Wattage
 - g. Minimum/Maximum Run-time
 - h. Average Run-time
 - i. Last Run-time
 - j. Cycle/Event Counter
 - k. Run Time Counter (Hour Meter)
22. Diagnostics Menu LED
23. Initialize System Menu LED
24. Run Limit Menu LED
25. Alarm Delay Menu LED
26. Power Delay Menu LED
27. Pump alternating options (no alternation, adjustable time based and test)
28. Pump alternating time options — 24 hours to 72 hours in 12-hour increments

Generator Receptacle and Auto Transfer – The alarm panel shall include a 20 amp, 250 VAC generator receptacle with a spring-loaded, gasketed cover suitably mounted to provide access for connection of an external generator while maintaining a NEMA 4X rating. An automatic transfer switch shall be provided, which automatically switches from AC power to generator power. Power shall be provided to the alarm panel through the generator receptacle whenever power is present at the receptacle, allowing the audible and visual alarms to function normally in generator mode. When power is no longer applied to the generator receptacle, the panel is automatically switched back to the AC Mains power.

2.15 External Autodialer –

1. Four separate voice message alarm zones
2. Calls up to 8 telephones, cell phones or pagers
3. Built-in line seizure
4. Remote Turn Off feature allows termination of activated channel
5. EEPROM Memory retains program despite power loss
6. Listen-in verification and communication
7. Universal dial tone
8. Built-in auxiliary output to drive external siren, strobe or relay
9. Five optional settings for notifications of a power loss occurrence — instantaneous, 15 minutes, 2 hours, 12 hours or 24 hours
10. One channel for power-loss sensing, three hardwired channels for additional input
11. Dialer senses loss of power and based on setting; will notify parties of loss condition only when specified time has elapsed
12. If power restores before set time has elapsed, no call will be made
13. Package includes battery backup and transformer

2.16 Serviceability:

- A. The grinder pump core, including level sensor assembly, shall have two lifting hooks complete with lift-out harness connected to its top housing to facilitate easy core removal when necessary. The level sensor assembly must be easily removed from the pump assembly for service or replacement. All mechanical and electrical connections must provide easy disconnect capability for core unit removal and installation. Each EQD half must include a water-tight cover to protect the internal electrical pins while the EQD is unplugged. A pump push-to-run feature will be provided for field trouble shooting. The push-to-run feature must operate the pump even if the level sensor assembly has been removed from the pump assembly. All motor control components shall be mounted on a readily replaceable bracket for ease of field service.

2.17 OSHA Confined Space:

- A. All maintenance tasks for the grinder pump station must be possible without entry into the grinder pump station (as per OSHA 1910.146 permit-required confined spaces).

2.18 Safety:

- A. The grinder pump shall be free from electrical and fire hazards as required in a residential environment. As evidence of compliance with this requirement, the completely assembled and wired grinder pump station shall be listed by underwriters laboratories, inc., to be safe and appropriate for the intended use. UL listing of components of the station, or third-party testing to ul standard are not acceptable.

The grinder pump shall meet accepted standards for plumbing equipment for use in or near residences, shall be free from noise, odor, or health hazards, and shall have been tested by an independent laboratory to certify its capability to perform as specified. As evidence of compliance with this requirement, the grinder pump shall bear the seal of NSF International. Third-party testing to NSF standard is not acceptable.

Part 3 Execution

3.1 Factory Test:

- A. Each grinder pump shall be submerged and operated for 1.5 minutes (minimum). Included in this procedure will be the testing of all ancillary components such as, the anti-siphon valve, check valve, discharge assembly and each unit's dedicated level controls and motor controls. All factory tests shall incorporate each of the above listed items. Actual appurtenances and controls which will be installed in the field shall be particular to the tested pump only. A common set of appurtenances and controls for all pumps is not acceptable. Certified test results shall be available upon request showing the operation of each grinder pump at two different points on its curve. Additional validation tests include: integral level control performance, continuity to ground and acoustic tests of the rotating components.

The ENGINEER reserves the right to inspect such testing procedures with representatives of the OWNER, at the GRINDER PUMP MANUFACTURER'S facility.

All completed stations shall be factory leak tested to assure the integrity of all joints, seams and penetrations. All necessary penetrations such as inlets, discharge fittings and cable connectors shall be included in this test along with their respective sealing means (grommets, gaskets etc.).

3.2 Delivery:

- A. All grinder pump core units, including level controls, will be delivered to the job site 100 percent completely assembled, including testing, ready for installation. Grinder pump cores will be shipped separately from the tanks. Installing the cores and discharge piping/hose into the tanks is the only assembly step required and allowed due to the workmanship issues associated with other on-site assembly. Grinder pump cores must be boxed for ease of handling.

3.3 Installation:

- A. Earth excavation and backfill are specified elsewhere, but are also to be done as a part of the work under this section, including any necessary sheeting and bracing.

The CONTRACTOR shall be responsible for handling ground water to provide a firm, dry subgrade for the structure, and shall guard against flotation or other damage resulting from general water or flooding.

The grinder pump stations shall not be set into the excavation until the installation procedures and excavation have been approved by the ENGINEER.

Remove packing material. User instructions MUST be given to the OWNER. Hardware supplied with the unit, if required, will be used at installation. The basin will be supplied with a standard 4" inlet grommet (4.50" OD) for connecting the incoming sewer line. Appropriate inlet piping must be used. The basin may not be dropped, rolled or laid on its side for any reason.

Installation shall be accomplished so that 1 inch to 4 inches of accessway, below the bottom of the lid, extends above the finished grade line. The finished grade shall slope away from the unit. The diameter of the excavated hole must be large enough to allow for the concrete anchor.

A 6-inch (minimum) layer of naturally rounded aggregate, clean and free flowing, with particle size of not less than 1/8" or more than 3/4" shall be used as bedding material under each unit.

A concrete anti-flotation collar, as detailed on the drawings, and sized according to the manufacturer's instructions, shall be required and shall be pre-cast to the grinder pump or poured in place. Each grinder pump station with its pre-cast anti-flotation collar shall have a minimum of three lifting eyes for loading and unloading purposes.

If the concrete is poured in place, the unit shall be leveled, and filled with water, to the bottom of the inlet, to help prevent the unit from shifting while the concrete is being poured. The concrete must be manually vibrated to ensure there are no voids. If it is necessary to pour the concrete to a level higher than the inlet piping, an 8" sleeve is required over the inlet prior to the concrete being poured.

The electrical enclosure shall be furnished, installed and wired to the grinder pump station by the CONTRACTOR.

The CONTRACTOR shall mount the alarm device in a conspicuous location, as per national and local codes. The alarm panel will be connected to the grinder pump station by a length of 6-conductor type TC cable as shown on the contract drawings. The power and alarm circuits must be on separate power circuits. The grinder pump stations will be provided with 32 feet total, 25 feet of useable, electrical supply cable to connect the station to the alarm panel. This cable shall be supplied with a FACTORY INSTALLED EQD half to connect to the mating EQD half on the core.

3.4 Backfill Requirements:

- A. Proper backfill is essential to the long-term reliability of any underground structure. Several methods of backfill are available to produce favorable results with different native soil conditions. Class 1b backfill, per ASTM 2321, is to surround the unit to grade.

Backfill of clean, native earth, free of rocks, roots, and foreign objects, shall be thoroughly compacted in lifts not exceeding 12" to a final Proctor Density of not less than 85%. Improper backfilling may result in damaged accessways. The grinder pump station shall be installed at a minimum depth from grade to the top of the 1 1/4" discharge line, to assure maximum frost protection. The finish grade line shall be 1" to 4" below the bottom of the lid, and final grade shall slope away from the grinder pump station.

3.5 Start-Up and Field Testing:

- A. The manufacturer shall provide the services of qualified factory trained technician(s) who shall inspect the placement and wiring of each station, perform field tests as specified herein, and instruct the owner's personnel in the operation and maintenance of the equipment before the stations are accepted by the owner.

All equipment and materials necessary to perform testing shall be the responsibility of the CONTRACTOR.

Upon completion of the installation, the authorized factory technician(s) will perform the following test on each station:

1. Make certain the discharge shut-off valve in the station is fully open.
2. Turn ON the alarm power circuit and verify the alarm is functioning properly.
3. Turn ON the pump power circuit. Initiate the pump operation to verify automatic "on/off" controls are operative. The pump should immediately turn ON.
4. Consult the Manufacturer's Service Manual for detailed start-up procedures.

Upon completion of the start-up and testing, the MANUFACTURER shall submit to the ENGINEER the start-up authorization form describing the results of the tests performed for each grinder pump station. Final acceptance of the

system will not occur until authorization forms have been received for each pump station installed and any installation deficiencies corrected.

Part 4 Operation and Maintenance

4.1 Manuals:

- A. The manufacturer shall supply four copies of operation and maintenance manuals to the owner, and one copy of the same to the engineer.

END OF SECTION

Part 1 General

1.1 Section Includes

- A. Furnish and install storm drainage facilities including drain piping, fittings, accessories and bedding; catch basins; manholes and other facilities.

1.2 Related Sections

- A. Section 31 20 00 – Earthwork
- B. Section 31 23 33 – Trenching and Backfilling

1.3 Submittals

- A. Submit the following in accordance with Owner's requirements:
- B. Action Submittals:
 - 1. Shop Drawings: Indicate openings in inlets and junction boxes, inverts, and sizes. Indicate grating type and installation.
 - 2. Product data: Provide product data for precast structures, pipe, and pipe accessories.
 - 3. As-Built Survey: Field-run as-built survey shall be provided as outlined on the drawings.
- C. Informational Submittals:
 - 1. Product Data Placing Pipe: Submit printed copies of the manufacturer's recommendations for installation procedures of the material being placed, prior to installation.
 - 2. Manufacturer's Certificate: Certify that products meet or exceed applicable state DOT requirements.

1.4 Delivery, Storage, and Handling

- A. Delivery and Storage
 - 1. Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling.
 - 2. Materials shall not be stored directly on the ground.
 - 3. The inside of pipes and fittings shall be kept free of dirt and debris.

4. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material.
5. Keep a copy of the manufacturer's instructions available at the construction site at all times and follow these instructions unless directed otherwise by the Engineer.
6. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install plastic pipe shall be stored in accordance with the manufacturer's recommendations and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

B. Handling

1. Materials shall be handled in a manner that ensures delivery to the trench in sound, undamaged condition.
2. Pipe shall be carried to the trench, not dragged.

Part 2 Products

2.1 Pipe for Culverts and Storm Drains

- A. Pipe for culverts and storm drains shall be of the sizes indicated and shall conform to the requirements specified.

2.2 Round Concrete Pipe

- A. Manufactured in accordance with and conforming to AASHTO M 170, Class III.

B. Gaskets:

1. Materials: Flexible watertight joints shall be made with plastic or rubber-type gaskets for concrete pipe. The rubber-type gaskets shall conform to AASHTO M 198, with the additional requirement that they shall be of sufficient volume to fill the pipe joint space. Gaskets shall have not more than one factory-fabricated splice.
2. Test Requirements: Watertight joints shall be tested and shall meet test requirements of paragraph HYDROSTATIC TEST ON WATERTIGHT JOINTS. Rubber gaskets shall comply with the oil resistant gasket requirements of AASHTO M 198. Certified copies of test results shall be delivered to the Engineer before gaskets or jointing materials are installed.

2.3 Reinforced Arch Culvert and Storm Drainpipe

- A. Manufactured in accordance with and conforming to AASHTO M 206, Class A-III.

- B. Joint Sealing Materials: Flexible watertight joints shall be made with bituminous plastic cement conforming to ASTM C990.

2.4 Perforated Piping

- A. Polyvinyl Chloride (PVC) Pipe: ASTM D2729.

2.5 PVC Pipe

- A. Submit the pipe manufacturer's resin certification, indicating the cell classification of PVC used to manufacture the pipe, prior to installation of the pipe.
- B. Type PSM PVC Pipe: ASTM D3034, Type PSM, maximum SDR 35, produced from PVC certified by the compounder as meeting the requirements of ASTM D1784, minimum cell class 12454-B.
- C. Corrugated PVC Pipe: ASTM F949 produced from PVC certified by the compounder as meeting the requirements of ASTM D1784, minimum cell class 12454-B.
- D. Joints shall be solvent cement or elastomeric gasket type in accordance with the specification for the pipe and as recommended by the pipe manufacturer.

2.6 HDPE Pipe

- A. All HDPE storm drainage pipe shall be dual wall with exterior corrugations and smooth interior surface meeting the following requirements:
 - 1. 4- through 10-inch (100 to 250 mm) pipe shall meet AASHTO M252, Type S or SP.
 - 2. 12- through 60-inch (300 to 1500 mm) pipe shall meet AASHTO M294, Type S or SP, or ASTM F2306.

2.7 Drainage Structures

- A. Flared End Sections: Sections shall be of a standard design fabricated from zinc coated steel sheets meeting requirements of ASTM A929/A929M.
- B. Precast Reinforced Concrete Box: Manufactured in accordance with and conforming to ASTM C1433.
- C. All other drainage structures shall conform to FDOT specifications, current edition.

2.8 Miscellaneous Materials

- A. Concrete

1. Unless otherwise specified, concrete and reinforced concrete shall conform to the requirements for psi concrete under Section 03 30 00 - Cast-In-Place Concrete. The concrete mixture shall have air content by volume of concrete, based on measurements made immediately after discharge from the mixer, of 5 to 7 percent when maximum size of coarse aggregate exceeds 1-1/2 inches. Air content shall be determined in accordance with ASTM C231. The concrete covering over steel reinforcing shall not be less than 1 inch thick for covers and not less than 1-1/2 inches thick for walls and flooring. Concrete covering deposited directly against the ground shall have a thickness of at least 3 inches between steel and ground.
 2. Expansion-joint filler material shall conform to ASTM D1751, or ASTM D1752, or shall be resin-impregnated fiberboard conforming to the physical requirements of ASTM D1752.
- B. Mortar: Mortar for connections to other drainage structures, and brick or block construction shall conform to ASTM C270, Type M, except that the maximum placement time shall be 1 hour. The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar. Water shall be clean and free of harmful acids, alkalis, and organic impurities. The mortar shall be used within 30 minutes after the ingredients are mixed with water. The inside of the joint shall be wiped clean and finished smooth. The mortar head on the outside shall be protected from air and sun with a proper covering until satisfactorily cured.
- C. Brick: Brick shall conform to ASTM C62, Grade SW; ASTM C55, Grade S-I or S-II; or ASTM C32, Grade MS. Mortar for jointing and plastering shall consist of one-part portland cement and two parts fine sand. Lime may be added to the mortar in a quantity not more than 25 percent of the volume of cement. The joints shall be filled completely and shall be smooth and free from surplus mortar on the inside of the structure. Brick structures shall be plastered with 13 mm 1/2 inch of mortar over the entire outside surface of the walls. For square or rectangular structures, brick shall be laid in stretcher courses with a header course every sixth course. For round structures, brick shall be laid radially with every sixth course a stretcher course.
- D. Precast Reinforced Concrete Manholes
1. Conform to ASTM C478. Joints between precast concrete risers and tops shall be full-bedded in cement mortar and shall be smoothed to a uniform surface on both interior and exterior of the structure made with flexible watertight, rubber-type gaskets.
- E. Frame and Cover for Gratings
1. Submit certification on the ability of frame and cover or gratings to carry the imposed live load.
 2. Frame and cover for gratings shall be cast gray iron, AASHTO M105, Class A; or cast ductile iron, ASTM A536, Grade 65-45-12. Weight, shape, size, and waterway openings for grates and curb inlets shall be as indicated on the

plans. The word "Storm Sewer" shall be stamped or cast into covers so that it is plainly visible.

2.9 Steel Ladder

- A. Steel ladder shall be provided where the depth of the storm drainage structure exceeds 4 feet. These ladders shall be not less than 16 inches in width, with 3/4-inch diameter rungs spaced 12 inches apart. The two stringers shall be a minimum 3/8 inch thick and 2-1/2 inches wide. Ladders and inserts shall be galvanized after fabrication in conformance with ASTM A123.

2.10 Downspout Boots

- A. Boots used to connect exterior downspouts to the storm-drainage system shall be of gray cast iron conforming to ASTM A48, Class 30B or 35B. Shape and size shall be as indicated.

2.11 Resilient Connectors

- A. Flexible, watertight connectors used for connecting pipe to manholes and inlets shall conform to ASTM C923.

2.12 Hydrostatic Test on Watertight Joints

- A. Concrete, PVC, and PE Pipe: A hydrostatic test shall be made on the watertight joint types as proposed. Only one sample joint of each type needs testing; however, if the sample joint fails because of faulty design or workmanship, an additional sample joint may be tested. During the test period, gaskets or other jointing material shall be protected from extreme temperatures which might adversely affect the performance of such materials. Performance requirements for joints in reinforced and non-reinforced concrete pipe shall conform to ASTM C990 or ASTM C443. Test requirements for joints in PVC and PE plastic pipe shall conform to ASTM D3212.

Part 3 Execution

3.1 Excavation for Pipe Culverts, Storm Drains, and Drainage Structures

- A. Excavation of trenches, and for appurtenances and backfilling for culverts and storm drains, shall be in accordance with the applicable portions of Section 31 20 00 - Earthwork and the requirements specified below.
- B. Trenching
 - 1. The width of trenches at any point below the top of the pipe shall be not greater than the outside diameter of the pipe plus six (6) inches to permit satisfactory jointing and thorough tamping of the bedding material under and

around the pipe. Sheeting and bracing, where required, shall be placed within the trench width as specified, without any overexcavation.

2. Where trench widths are exceeded, redesign with a resultant increase in cost of stronger pipe or special installation procedures will be necessary. Cost of this redesign and increased cost of pipe or installation shall be borne by the Contractor without additional cost to the Owner.

C. Removal of Unstable Material

1. Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by the Owner's on-site Geotechnical Engineer, is unexpectedly encountered in the bottom of a trench, such material shall be removed to the depth required and replaced to the proper grade with select granular material, compacted as provided in paragraph BACKFILLING.
2. When removal of unstable material is due to the fault or neglect of the Contractor while performing shoring and sheeting, water removal, or other specified requirements, such removal and replacement shall be performed at no additional cost to the Owner.

3.2 Bedding

- A. The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.
- B. Concrete Pipe Requirements
 1. When no bedding class is specified or detailed on the drawings, concrete pipe shall be bedded in granular material minimum 4 inch in depth in trenches with soil foundation. Depth of granular bedding in trenches with rock foundation shall be 1/2 inch in depth per foot of depth of fill, minimum depth of bedding shall be 8 inch up to maximum depth of 24 inches.
 2. The middle third of the granular bedding shall be loosely placed.
 3. Bell holes and depressions for joints shall be removed and formed so entire barrel of pipe is uniformly supported. The bell hole and depressions for the joints shall be not more than the length, depth, and width required for properly making the particular type of joint.
- C. Plastic Pipe: Bedding for PVC and PE pipe shall meet the requirements of ASTM D2321. Use Class IB or II material for bedding, haunching, and initial backfill.

3.3 Placing Pipe

- A. Each pipe shall be thoroughly examined before being laid; defective or damaged pipe shall not be used. Plastic pipe shall be protected from exposure to direct

sunlight prior to laying, if necessary to maintain adequate pipe stiffness and meet installation deflection requirements.

- B. Pipelines shall be laid to the grades and alignment indicated.
- C. Proper facilities shall be provided for lowering sections of pipe into trenches. Lifting lugs in vertically elongated metal pipe shall be placed in the same vertical plane as the major axis of the pipe.
- D. Pipe shall not be laid in water, and pipe shall not be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary.
- E. Deflection of installed flexible pipe shall not exceed the following limits:

TYPE OF PIPE	MAXIMUM ALLOWABLE DEFLECTION (percent)
Plastic (PVC, HDPE)	5

- F. Note post installation requirements of paragraph DEFLECTION TESTING in PART 3 of this specification for all pipe products including deflection testing requirements for flexible pipe.
- G. Concrete and PVC Pipe: Laying shall proceed upgrade with spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow.
- H. PE Pipe: Laying shall be with the separate sections joined firmly on a bed shaped to line and grade and shall follow manufacturer's guidelines.

3.4 Jointing

- A. Concrete Pipe
 - 1. Flexible Watertight Joints: Gaskets and jointing materials shall be as recommended by the particular manufacturer in regard to use of lubricants, cements, adhesives, and other special installation requirements. Surfaces to receive lubricants, cements, or adhesives shall be clean and dry. Gaskets and jointing materials shall be affixed to the pipe not more than 24 hours prior to the installation of the pipe, and shall be protected from the sun, blowing dust, and other deleterious agents at all times. Gaskets and jointing materials shall be inspected before installing the pipe; any loose or improperly affixed gaskets and jointing materials shall be removed and replaced. The pipe shall be aligned with the previously installed pipe, and the joint pushed home. If, while the joint is being made the gasket becomes visibly dislocated the pipe shall be removed and the joint remade.
 - 2. External Sealing Band Joint for Noncircular Pipe: Surfaces to receive sealing bands shall be dry and clean. Bands shall be installed in accordance with manufacturer's recommendations.

3.5 Drainage Structures

A. Manholes and Inlets

1. Construction shall be of reinforced concrete or precast reinforced concrete, complete with frames and covers or gratings; and with fixed galvanized steel ladders where indicated.
2. Pipe connections to concrete manholes and inlets shall be made with flexible, watertight connectors.

B. Walls and Headwalls: Construction shall be as indicated.

3.6 Steel Ladder Installation

- #### A.
- Ladder shall be adequately anchored to the wall by means of steel inserts spaced not more than 6 feet vertically, and shall be installed to provide at least 6 inches of space between the wall and the rungs. The wall along the line of the ladder shall be vertical for its entire length.

3.7 Backfilling

A. Backfilling Pipe in Trenches

1. After the pipe has been properly bedded, selected material from excavation or borrow, at a moisture content that will facilitate compaction, shall be placed along both sides of pipe in layers not exceeding 6 inches in compacted depth.
2. The backfill shall be brought up evenly on both sides of pipe for the full length of pipe. The fill shall be thoroughly compacted under the haunches of the pipe.
3. Each layer shall be thoroughly compacted with mechanical tampers or rammers. This method of filling and compacting shall continue until the fill has reached an elevation equal to the midpoint (spring line) of RCP or has reached an elevation of at least 12 inches above the top of the pipe for flexible pipe.
4. The remainder of the trench shall be backfilled and compacted by spreading and rolling or compacted by mechanical rammers or tampers in layers not exceeding six (6) inches.
5. Tests for density shall be made as necessary to ensure conformance to the compaction requirements specified below. Where it is necessary, in the opinion of the Owner's onsite Geotechnical Engineer, that sheeting or portions of bracing used be left in place, the contract will be adjusted accordingly.
 - a. Untreated sheeting shall not be left in place beneath structures or pavements.

B. Backfilling Pipe in Fill Sections

1. For pipe placed in fill sections, backfill material and the placement and compaction procedures shall be as specified below.
2. The fill material shall be uniformly spread in layers longitudinally on both sides of the pipe, not exceeding 6 inches in compacted depth, and shall be compacted by rolling parallel with pipe or by mechanical tamping or ramming.
3. Prior to commencing normal filling operations, the crown width of the fill at a height of 12 inches above the top of the pipe shall extend a distance of not less than twice the outside pipe diameter on each side of the pipe or 12 feet, whichever is less.
4. After the backfill has reached at least 12 inches above the top of the pipe, the remainder of the fill shall be placed and thoroughly compacted in layers not exceeding six (6) inches. Use select granular material for this entire region of backfill for flexible pipe installations.

C. Movement of Construction Machinery: When compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.

D. Compaction

1. Minimum Density
 - a. Backfill over and around the pipe and backfill around and adjacent to drainage structures shall be compacted at the approved moisture content to the following applicable minimum density, which will be determined as specified below.
 - b. Under paved roads, streets, parking areas, and similar-use pavements including adjacent shoulder areas, the density shall be not less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material, up to the elevation where requirements for pavement subgrade materials and compaction shall control.
 - c. Under unpaved or turfed traffic areas, density shall not be less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material.
 - d. Under nontraffic areas, density shall be not less than that of the surrounding material.
2. Determination of Density:

- a. Testing is the responsibility of the Contractor and performed at no additional cost to the Owner. Testing shall be performed by an approved commercial testing laboratory.
- b. Tests shall be performed in sufficient number to ensure that specified density is being obtained.
- c. Laboratory tests for moisture-density relations shall be made in accordance with ASTM D698 or ASTM D1557 as noted herein except that mechanical tampers may be used provided the results are correlated with those obtained with the specified hand tamper.
- d. Field density tests shall be determined in accordance with ASTM D2167 or ASTM D6938. When ASTM D6938 is used, the calibration curves shall be checked and adjusted, if necessary, using the sand cone method as described in paragraph Calibration of the referenced publications. ASTM D6938 results in a wet unit weight of soil and ASTM D6938 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D6938.
- e. Test results shall be furnished the Engineer. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed.

3.8 Pipeline Testing

A. Leakage Tests

1. Lines shall be tested for leakage by low pressure air or water testing or exfiltration tests, as appropriate.
 - a. Low pressure air testing for concrete pipes shall conform to ASTM C969.
 - b. Low pressure air testing for plastic pipe shall conform to ASTM F1417.
 - c. Low pressure air testing procedures for other pipe materials shall use the pressures and testing times prescribed in ASTM C828 or ASTM C969, after consultation with the pipe manufacturer.
2. Testing of individual joints for leakage by low pressure air or water shall conform to ASTM C1103. Prior to exfiltration tests, the trench shall be backfilled up to at least the lower half of the pipe. If required, sufficient additional backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permit inspection.
3. Visible leaks encountered shall be corrected regardless of leakage test results.

4. When the water table is 2 feet or more above the top of the pipe at the upper end of the pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to the Engineer.
5. An exfiltration test shall be made by filling the line to be tested with water so that a head of at least 2 feet is provided above both the water table and the top of the pipe at the upper end of the pipeline to be tested.
 - a. The filled line shall be allowed to stand until the pipe has reached its maximum absorption, but not less than 4 hours. After absorption, the head shall be reestablished.
 - b. The amount of water required to maintain this water level during a 2-hour test period shall be measured.
 - c. Leakage as measured by the exfiltration test shall not exceed 250 gallons per inch in diameter per mile of pipeline per day. When leakage exceeds the maximum amount specified, satisfactory correction shall be made and retesting accomplished.

B. Post-Installation Inspection

1. Check each reinforced concrete pipe installation for joint separations, soil migration through the joint, cracks greater than 0.01 inches, settlement, and alignment.
2. Check each flexible pipe (HDPE, PVC, CMP, PP) for rips, tears, joint separations, soil migration through the joint, cracks, localized bucking, bulges, settlement, and alignment.
3. Replace pipes having cracks greater than 0.1 inches in width or deflection greater than 5 percent deflection.
4. An engineer shall evaluate all pipes with cracks greater than 0.01 inches but less than 0.10 inches to determine if any remediation or repair is required.
5. Repair or replace any pipe with crack exhibiting displacement across the crack, exhibiting bulges, creases, tears, spalls, or delamination.
6. Reports: The final post installation inspection report shall include: a copy of all video taken, pipe location identification, equipment used for inspection, inspector name, deviation from design, grade, deviation from line, deflection and deformation of flexible pipe systems, inspector notes, condition of joints, condition of pipe wall (e.g. distress, cracking, wall damage dents, bulges, creases, tears, holes, etc.).

END OF SECTION

Conditions for Mechanical Systems (HVAC and Plumbing)

Part 1 General

1.1 Additional Information

- A. These conditions add to and supplement, The GENERAL and SPECIAL CONDITIONS of the contract documents. The General and Special Conditions are a part of this section and shall apply as if written in full herein.

1.2 Scope

- A. The work included in this section shall consist of providing all materials, labor, tools, and incidentals necessary to install and make ready for owner's use complete mechanical systems which include the heating, ventilation, and air conditioning system (HVAC) and the plumbing systems for the proposed building as called for in the contract documents.
- B. Review all drawings and visit the site; observe dimensions, construction, and details not shown on drawings.
- C. The following drawings are a part of the contract documents:
 - 1. CONCESSION STAND HVAC PLAN
 - 2. CONCESSION STAND EQUIPMENT SCHEDULES
 - 3. CONCESSION STAND HVAC NOTES AND DETAILS
 - 4. CONCESSION STAND HVAC HOOD DETAILS
 - 5. MAINTENANCE BUILDING MECHANICAL PLAN
 - 6. CONCESSION STAND WASTE, VENT AND GAS PLAN
 - 7. CONCESSION STAND HOT AND COLDWATER PLAN
 - 8. CONCESSION STAND PLUMBING NOTES

1.3 Responsibility of Bidders

- A. Bidders shall examine all drawings and specifications issued and SHALL VISIT THE SITE of the work. Bidders must be familiar with the codes, rules, and regulations (and the local interpretations) in effect at the site of the work.
- B. Where any of the above are at variance with the drawings and specifications, the code requirements, the code requirements shall take precedence, and any cost necessary to meet these shall be included in the bid price.
 - 1. This contractor is assumed to be skilled in the trade and is solely responsible

for compliance with health and safety regulations, performing the work in a safe and competent manner, and in installation procedures required for the work as outlined in these documents.

1.4 Mechanical Plans

- A. The mechanical plans are intended to be diagrammatic and are based on one manufacturer's equipment. They are not intended to show every item in its exact location, the exact dimensions, or all the details of the equipment. The contractor shall verify the actual dimensions of the equipment proposed to ensure that the equipment will fit in the available space.
- B. Installation shall be within the limitations imposed by the architectural, structural, electrical HVAC, and plumbing requirements, with adequate space for maintenance.

1.5 Questions and Clarifications of Bid Documents

- A. Bidders shall not rely on any verbal clarification of the drawings of specifications. Any questions or clarifications shall be referred to the architect and/or engineer at least five working days prior to bidding to allow for issuance of an addendum. After the five-day deadline, bidder shall make a decision and qualify the bid, if the bidder feels it necessary.

1.6 Ten-Day Prior Approval

- A. Any equipment or components proposed for this project, other than model numbers named in the bid documents, shall have pertinent submittal data and descriptive cover sheet submitted to the architect with a copy to the engineer 10 days prior to the bid date for inclusion in an addendum if, and when, reviewed and accepted for bidding.
- B. This is for prebid review and is not to be regarded as submittals required for construction.
- C. Bidder shall base the bid on items of equipment named in documents or addendums issued prior to bidding. Verbal acceptance will be recognized unless verified in writing. It is the bidder's responsibility to ascertain that all equipment has been accepted by requiring copies of the written acceptance from suppliers.

1.7 Guarantees

- A. All equipment, materials, and workmanship shall be guaranteed for a period of one year, beginning with the date of acceptance of the project in writing. Special warranties will be called for under some sections of EQUIPMENT. This warranty shall be in writing and shall include written copies of factory warranties with expiration dates on items of equipment where the warranty date might differ from the acceptance date, such as five-year warranty of sealed refrigerant systems. No warranty shall start before the acceptance date.

- B. The contractor's warranty shall include at least two inspections of the system to repair and replace any items found to be defective during this period. The first shall be approximately six months after the acceptance of the system and the second at the end of the first year.

1.8 Required Submittals

- A. Prior to starting any installation, submit no less than 5 nor more than 10 copies of items proposed for this work with necessary illustrations, drawings, and engineering data for review by the engineer. Submit in time to allow no less than 15 working days for checking and transmittal without delaying the construction schedule. Submit all items at one time no less than 30 days after award of the contract.
- B. Submittals shall be clearly marked to show the intended item, with identification as to unit number or other marking to show location, service, and function. Submittals not marked to identify the equipment and application will be rejected.
- C. Any equipment installed without prior acceptance shall be subject to rejection unless such items were identified by name and model number in the bid documents.
- D. The supplier, by submitting, certifies that the materials or equipment proposed is satisfactory for the application intended, including adverse conditions that may prevail at the job site, and that the materials and equipment are in current production with no known plans to cease production.
- E. Contractor agrees that submittals processed by the engineer are not change orders; that the purpose of submittals by the contractor is to demonstrate to the engineer that the contractor understands the design concept; and that this understanding is demonstrated by indicating which equipment and materials he or she intends to furnish and install and the fabrication and installation methods he or she intends to use.
- F. Contractor further agrees that if deviations, discrepancies, or conflicts between submittals and contract documents are discovered either prior to or after submittals are processed by the engineer, the contract documents shall control and shall be followed.
- G. Submittals shall include:
 - 1. All equipment; cooling, heating, ventilation, etc.
 - 2. Voltage, phase, and amps of each electrical item such as motors, heaters, etc.
 - 3. All auxiliary equipment
 - 4. Ductwork shop drawings, insulation, etc.
 - 5. Supply and return registers, grilles, etc.
 - 6. Pipes, valves, insulation, etc.

- a. At the close of the job, prior to final review, five bound copies of the following shall be submitted by transmittal to the architect or engineer for review and acceptance.
7. Equipment warranties
 8. Contractor's warranty
 9. list and manuals for all equipment
 10. Balance and Test readings
 11. Operating Instructions (in writing)
 12. Written instructions on maintenance and care of the system

Part 2 Products

2.1 General

- A. All products shall be first-line quality, of grade and type shown on the drawings and specified, or equivalents accepted by the architect or engineer in writing.
- B. All products shall be in current production with no notice having been given that this product is to be drastically changed, modified, or discontinued from production.
- C. The supplier, by submitting, certifies that equipment being proposed is proper for the application intended and that it has the capacity called for.

2.2 Complete System

- A. All products, materials, and accessories shall be furnished and installed as required for a complete system ready for owner's beneficial use.

2.3 Equipment and Material Deviations

- A. When any material or equipment is identified on the plans or in the Specifications by reference to ONE manufacturer's name or model number, it is intended to establish a required standard of design and quality, and it is not intended to limit competition. It is understood that the phrase "or accepted equivalent" is hereby inserted following the one manufacturer's name, whether such phrase occurs or not
- B. When the drawings and/or specifications indicate ONE or TWO manufacturers' names for material or equipment, the bidder may submit a bid based on material or equipment of manufacturers not named but considered by the bidder to be equal to the standard of design and quality specified; however, such substitution must be accepted by the architect or engineer as equal. If the bidder elects to bid on a substitution without securing written consent of the architect or engineer prior to receipt of bids, then it will be understood that proof of compliance with specified

requirements is the direct responsibility of the bidder and no such materials or equipment may be purchased or installed without written acceptance.

1. Bidders are advised to ascertain such acceptance from their suppliers by requesting copies of the acceptance in writing signed by the architect or engineer from their suppliers.

2.4 Motors and Starters

- A. All electric motors shall be high-efficiency type with maximum of 1750 rpm with open drip-proof enclosures. Motors located on air handling units shall be mounted in rubber supports, or the fan shall be independently supported on spring isolators. Motors located in the conditioned space shall be selected for quiet operation and shall not produce an objectionable "motor noise" in the space.
- B. Electrical characteristics shall be determined from the Electrical Drawings and verified on the job from the electrical contractor.
- C. Motor starters shall be sized by the National Electric Code (NEC), and proper heater elements shall be provided and installed. Starters shall have overload trip element in each phase.
- D. Larger motors and their starters shall meet the requirements of the utility company as to inrush allowable and the type of starting permitted.

2.5 Labeling

- A. All electrical equipment and items consisting primarily of electrical components shall bear a label of an independent testing laboratory, such as Underwriters' Laboratories (UL).
- B. Where such testing and labeling service is available for other products, such as fire dampers, boilers, etc., the equipment shall bear such a label.

Part 3 Execution

3.1 Workmanship

- A. All work shall be performed by competent mechanics using proper tools and equipment to produce first-quality work. All work shall be neatly installed, accessible for maintenance, and complete with all accessories required.

3.2 Accessibility

- A. All equipment shall be installed in such a way that all components requiring access (such as drain pans, drains, fire dampers, control dampers, control operators, motors, drivers, etc.) are so located and installed that they may be serviced, reset, replaced, or recalibrated, etc., by service people with normal service tools and

equipment. If any equipment or components are shown in such a position that this contractor cannot comply with the above, the contractor shall notify the general contractor and attempt to resolve the problem of access. If this consultation is not successful, the architect and engineer shall be notified in writing and a decision requested.

3.3 Work by Other Trades

- A. Cutting, patching, furring, painting, electrical, plumbing, etc., shall be done by the affected trade at this contractor's expense for changes required in work already installed or work required by other trades for changes made by this contractor in type or size of equipment purchased.

3.4 Work Not Included

- A. Openings in floors, walls, and roof shall be furnished by the general contractor. This contractor shall inform the general contractor of the location and size required. This contractor shall furnish all sleeves, frames, including framing between joist unless shown on the Architectural or Structural drawings, access doors, prefabricated curbs, and other accessories necessary for a complete installation. Only those items specifically shown and/or specified in other Sections are excluded.
- B. Flashing of roof for curbs, pipes, stands, etc., shall be by the general contractor (roofer). (Curbs and counter flashing shall be by the HVAC contractor).
- C. Power wiring, including final connections, is by the electrical contractor. (This contractor shall install all motors and furnish the starting equipment to the electrical contractor for installation. Control wiring, including 115 volts from power source, conduit, switches, thermostats, interlocks, etc., shall be furnished by this contractor unless specifically shown on the Electrical Drawings. This contractor shall see that the electrical equipment does not block access to service areas of equipment, i.e., disconnect switches mounted on the compressor or control access doors of equipment.)
- D. Power and fuel for testing. General contractor shall provide power for buildings under construction. See General and Special Conditions.

3.5 Work for Other Trades

- A. This contractor shall furnish all vents required for water heaters, dryer vents, and other mechanical openings, as shown on the drawings.

3.6 Foundations and Special Supports

- A. Furnish and install all special foundations and supports required for equipment installed under this Section unless they are a part of the building structure and are shown in other Sections.

3.7 Noise and Vibration

- A. Install vibration isolators, flexible connectors, expansion joints, and other safety measures to prevent noise and vibration from being transmitted to occupied areas. Equipment shall be selected to operate within the noise level recommended for the installation in relation to its location.
- B. Following installation, make proper adjustments to eliminate excessive noise and vibration.

3.8 Permits, Codes, and Laws

- A. All work shall be in accordance with the following rules and regulations and any applicable laws.
- B. Where any there are at variance with the drawings and specifications, the code requirements shall take precedence and any cost necessary to meet these shall be included in the contract.
- C. This contractor is assumed to be skilled in the trade and is solely responsible for compliance with OSHA regulations, performing the work in a safe and competent manner, and in installation procedures required for this work. All supervision assigned to this project shall be experienced in this type of work. This contractor's superintendent shall be designated as Safety Inspector unless the contractor designates another person and notifies the engineer of this change.

3.9 Review by Engineer

- A. This contractor shall notify the engineer at the appropriate stage of construction so that the engineer may visit the site for review and consultation.
- B. Should this contractor fail to notify the engineer at the appropriate time, it shall then be his or her responsibility and cost to make mechanical systems accessible, expose any concealed lines or demonstrate the acceptability of any part of the system. Any extra cost, caused by the removal of work by other trades, shall be borne by this contractor.

3.10 Early Start-Up

- A. This contractor shall do all possible to see that the mechanical equipment is connected with electrical power as early as possible, so that final balancing and testing can be started. Should this contractor be ready for operation and power is not available, the general contractor and the architect or engineer shall be notified.

3.11 Cleaning and Painting

- A. Thoroughly clean all equipment and remove all trash, cartons, etc., from the area. Make any necessary corrections or repair/replace any damaged materials or equipment. Leave the entire system in a thoroughly clean and orderly manner.

- B. Any finished surfaces that have been scratched or discolored shall be touched up or repainted with paint to match the original color. If any part has been bent, broken, or otherwise damaged, it shall be replaced prior to final review.
- C. All metal items inside the building subject to rusting, and all ferrous metal exposed to weather, shall be given one coat of rust preventive primer as soon as installed.

END OF SECTION

Part 1 General

- A. The General and Supplementary Conditions of these specifications shall apply to and form a part of this section as if written in full herein.

1.1 Scope of Work

- A. The work covered by this section of the specifications shall include the furnishing of all labor, equipment, supplies, tools and materials, and the performance of all operations necessary for the installation of complete wiring systems, lighting, power, connections to equipment specified in other sections, electric service connections, and electrical equipment in strict accordance with this section of the specifications and applicable drawings.

1.2 Definitions

- A. Provide means to furnish and install.

1.3 Submittals and Warranty

- A. The contractor shall submit a list of principal material items, giving manufacturers' names, catalog cuts and approval of the submittal data shall be obtained from the Engineer before orders are placed. Submittals are required on the following: Panels and breakers, safety switches, dry type transformers, conduit, conductors, cables, wiring devices and plates, light fixtures, poles, brackets, lighting controls, site point-point photometric analysis.
- B. Material submittals shall be all-inclusive with all items requiring submittals being submitted at the same time. Individual submittals will be returned without being checked. Electronic submittals are required.
- C. Submittal package shall include a cover sheet giving the names of the project, lead design team and electrical engineer. Cover sheet shall also include the names, addresses, and telephone numbers of the General Contractor, Electrical Contractor, and Electrical Suppliers. Submittals without this information will be returned without being checked.
- D. Contractor shall fully instruct Owner in operation and maintenance of electrical system.
- E. Contractor shall assemble and bind manufacturers' operating and maintenance literature for inclusion in Maintenance Manual.

Literature shall include record shop drawings, wiring diagrams, instruction sheets, replacement parts list, warranties, and guarantee for all equipment furnished under this section of the specifications. Three sets of such literature shall be provided.

- F. Contractor shall warrant all work for a period of one year from date of substantial completion. Contractor shall rectify any defects due to faulty materials or workmanship and pay for any damage to other work resulting therefrom which occurs within said period. Work shall be performed by journeyman electrician or an electrician with 8,000 hours experience as an apprentice electrician and with new materials as approved by the Engineer. The Owner will give notice of observed defects with reasonable promptness. The above warranty is in addition to any guarantee of equipment by a manufacturer.
- G. Contractor shall furnish written warranty that all systems have been installed complete and are functioning properly and that all materials and workmanship are free from defects.
- H. The General Conditions, Supplementary Conditions, and Special Conditions to the overall specifications are made a part of the electrical specifications where applicable.

1.4 Drawings

- A. The drawings are schematic showing relative locations and connections and shall not be scaled for exact locations. Unless specified dimensions are shown, the structural, Engineerural and site conditions shall govern the exact locations.
- B. Should any difficulty occur in the running of conduits, setting of cabinets, outlets, fixtures or any other devices or connections at the points shown, provide necessary minor deviations therefrom as approved without additional cost.
- C. Where conflicts occur between the requirements of the drawings, specifications, and applicable codes, the contractor shall provide an installation that conforms to the most stringent requirement.

1.5 As-Built Drawings and Records:

- A. Maintain a complete set of electrical prints for indicating all changes. Deliver an electronic file to the Owner's representative upon completion. Elevations and dimensioned locations of underground work shall be indicated. Dimension to permanent references.

Part 2 Products

2.1 Materials

- A. Materials and equipment shall be new, standard current products of manufacturers regularly engaged in the production of such equipment and shall be the manufacturer's latest design.
- B. All materials shall bear the label of the Underwriter's Laboratory for the intended use or shall be materials approved by the code enforcing authorities and the Engineer/Engineer.
- C. Materials shall be delivered to the site in the manufacturer's original unopened containers except where prior approval and inspection is obtained from the Engineer. Materials shall be inspected prior to storage. Damaged, defective, or improper equipment shall be replaced or repaired at the expense of the Contractor and in a manner meeting with approval of the Engineer. Electrical cables shall be handled and stored carefully to avoid damage to the insulation and damage from weather. All metallic materials shall be suitably protected against corrosion.
- D. Specific references to any article, device, product, material, fixture, form or type of construction by name, make, or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. The contractor may use any article, device, product, material, fixture, form or type of construction which in the judgment of the Engineer expressed in writing is equal to that specified. Seven day prior approval is required for all substitutions.
- E. The contractor shall coordinate sizes indicated for electrical components such as circuit breakers, disconnects, feeders and starters with requirements for equipment provided and shall notify the Engineer if any item is inadequate in size for equipment installed or proposed. Contractor shall install as a minimum the size indicated unless he receives in writing from the Engineer directions to reduce the component in size.
- F. When the equipment to be installed has a requirement which is greater than shown, the Contractor shall increase the size of the electrical component as work under the section of this specification which installs the equipment requiring the same. Modifications to the contract will not be issued for failure to coordinate with other trades or with the requirements of owner furnished equipment.

2.2 Hardware

- A. All hardware and accessory fittings shall be of a type designed, intended or appropriate for the use, and complement the items with which they are used, and shall have corrosion protection suitable for the atmosphere in which they are installed. All such hardware shall be U.S. Standard sizes.

2.3 Equipment

- A. Equipment of a similar nature shall be identical. Example: All panelboards shall be of the same manufacturer and of the same style.

2.4 Material Protection

- A. Store and protect all materials from damage prior to installation. Materials shall not be stored directly on the ground or floor, shall be kept as clean and dry as possible, and shall be kept away from damaging or deteriorating elements. Damaged materials shall not be installed.

Part 3 Execution

3.1 Installation

- A. All work will be installed in accordance with regulations of the National Electrical Code, the Life Safety Code, and ordinances of the state and local governments.
- B. Contractor shall obtain all necessary permits and inspections as required and pay all charges for same and shall turn over to the Engineer Certificate of final inspection. Should any part of the design fail to comply with such requirements, discrepancy shall be called to the attention of the Engineer prior to submission of bid.
- C. Follow the installation directions and recommendations of the material and equipment manufacturers.
- D. Materials damaged during installation shall be repaired to a new condition or shall be replaced. Finishes on equipment which have been scratched or marred shall be touched up to match finish or shall be completely refinished.

3.2 Scheduling of Work

- A. Electrical feeders, branch wiring, signal wiring, and other similar work shall be scheduled to correspond with the sequence of work necessary to construct new work.
- B. Electrical work shall be scheduled to provide an orderly installation without causing any delays in the overall construction of the project.

3.3 Identification

- A. Identify all equipment as to its source, its use and what it serves and characteristics. Equipment includes safety switches, starters, panels, terminal boxes, motors and special outlets. Identification shall correspond to the terminology of the Contract Documents.

- B. Use Brady markers on conductors. Use Manufacturer's nameplates and directories where available. Use of Dymo Labels will not be permitted. Use of uniform painted stencils will be permitted. Use of Micarta nameplates will be permitted: 1/4" white letters on black background.

3.4 Temporary Service and Supervision

- A. Temporary power and construction lighting shall be provided as needed under this section of the specifications. Both shall be provided in a safe and sufficient manner for the orderly completion of the work. The cost of power shall be paid for by the general contractor.
- B. All work shall be performed under the direct supervision of a journeyman electrician or an electrician with 8,000 hours experience as an apprentice electrician.

END OF SECTION

Part 1 General

1.1 General Requirements

- A. This section includes basic materials and methods for all of Division 26, electrical and related work.

1.2 Applicable Requirements:

- A. NEC Article 310 and 400

Part 2 Products

2.1 Conductors

- A. All conductors shall be copper, shall conform to applicable ASTM specifications as to conductivity, and shall be free from kinks and defects when installed. Minimum size conductor shall be #12 AWG. For home runs over 100 feet, minimum size conductor shall be #10 AWG.
- B. Conductors #10 AWG and smaller shall be solid with color coded insulation.
- C. Conductors #8 AWG and larger shall be stranded and marked with color coded tape at all terminations, junction boxes, and pull boxes.
- D. Insulation for general building wiring and feeders shall be THWN or THWN-2.
- E. Insulation for wiring in the vicinity of heat producing equipment shall be type AF or other type suitable for the application.
- F. Conductors for power and lighting shall be installed in conduit.

2.2 Splices and Terminations:

- A. Connections shall comply with Federal Specification W-S-61b. Connectors for temperatures to 105 degrees C. shall be Ideal-Wing Nut or 3M-Schotchloc or equals by AMP or Thomas & Betts. Connectors for temperatures to 150 degrees C. for use in fixtures shall be Ideal-Wire Nut or equal by 3M, Thomas & Betts, or AMP.
- B. Tape shall be Scotch 33 or equals by Thomas & Betts, or Plymouth Bishop. Voids shall be filled with rubber tape.

Part 3 Execution

3.1 Conductors

- A. Conductors size #10 and smaller shall be copper and have insulation colored for phases A, B, C, and N respectively as follows for three phase systems: 120/208 Volts - black, red, blue, and white; 277/480 Volts – brown, orange, yellow, and gray.
- B. Bonding conductors size #10 and smaller shall have a green covering and shall be the same size as the circuit conductors unless otherwise indicated. Bonding conductors shall be installed as required by the NEC.
- C. Equipment grounding conductors shall be green for 120/208 volt system and green with white stripe for 277/480 volt system.
- D. Installation of conductors shall be made only in completed raceway systems and all conductors in any conduit shall be pulled together.
- E. Use wire pulling compounds or lubricants as listed by Underwriter's Laboratories.

3.2 Splices and Terminations

- A. Use solderless terminal lugs on all stranded conductors. Use approved solderless connectors for all splices. Keep splices to a minimum. Splices shall not be pulled in conduits. Use approved junction boxes.
- B. Splice all neutrals prior to connection to wiring devices. Splices other than pre-insulated connectors shall be covered neatly with insulation tape equivalent in value to the conductor insulation. Use minimum of two layers of tape.

3.3 Phasing and Identification

- A. The plans designation of all secondary conductors shall be the same and shall be indicated in or on all 3 phase outlets, panelboards, and disconnect switches, and they shall be connected with uniform phase sequence.
- B. Maintain A, B, C phase rotation left to right, top to bottom, front to rear when viewed from the front.

END OF SECTION

Part 1 General

1.1 General Requirements

- A. This section includes basic materials and methods for all of Division 26.

1.2 Applicable Requirements:

- A. NEC Article 250

Part 2 Products

2.1 Ground Rods

- A. Ground rods shall be 3/4" diameter in ten ft sections with threaded end for screw couplings. Material for ground rods shall be solid copper.

2.2 Conductors

- A. The grounding electrode conductor shall be soft drawn bare copper. The grounding electrode conductor shall be sized in accordance with the drawings and requirements of section 250 of the NEC.
- B. Equipment grounding conductors shall be copper with green colored insulation, or for sizes #8 and larger, green colored tape may be used to cover the exposed insulation of the equipment grounding conductor in all panels, junction boxes and equipment connection compartments.

Part 3 Execution

3.1 Grounding Electrode System

- A. Ground connection shall be made in accordance with NEC 250.50 to a metal underground water pipe in direct contact with the earth for 10 ft or more and electrically continuous, to the metal frame of the building where effectively grounded, and to a concrete encased electrode.
- B. Supplement the metallic water service grounding system with an additional driven electrode system. The driven electrode system shall consist as a minimum of three 30 ft ground rods driven in a triangular pattern on 10 ft centers. All three rods shall be connected together with the grounding electrode conductor.

- C. The maximum resistance to ground of the grounding system shall not exceed twenty-five ohms under normal dry conditions. Where the resistance obtained exceeds twenty-five ohms, a change order shall be issued by the owner to provide additional driven ground rods or to provide a grounding well as deemed necessary by the owner. The cost of obtaining the required minimum resistance to ground of the ground system shall be paid by the owner and shall not be the responsibility of the Engineer or the Contractor.
- D. Test the grounding system to assure continuity and that the resistance to ground is not excessive. Make resistance measurements in normally dry weather, not less than 48 hours after rainfall. Make ground resistance measurements with a ground resistance test meter equal to AEMC Model 6416 and calibrated within the last twelve months.
- E. Test forms for each grounding electrode system shall be delivered to the Architect prior to substantial completion of project. Test form shall include test data, test meter model and manufacturer, calibration date, and signature of person performing the test.
- F. Connections shall be made so that the contact between the grounding electrode and the grounding electrode conductor is maximized. Exothermic welding process or Burndy Hy-Ground compression system is required.

3.2 Equipment Grounding

- A. All exposed non-current carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in non-metallic raceway systems and the neutral conductor of wiring systems shall be grounded.
- B. A separate equipment grounding conductor shall be installed in all conduits and shall be sized in accordance with NEC Table 250.122. The equipment grounding conductor shall be separate from the electrical system neutral conductor.

END OF SECTION

Part 1 General

1.1 Scope

- A. This section includes basic materials and electrical methods for all of Division 26, electrical related work.

Part 2 Products

2.1 Raceways and Fittings

- A. Rigid or Intermediate Grade Steel conduit shall be mild steel produced to ANSI C80.1 and Federal Specification WW-C-581 and shall be Underwriter's approved hot dipped galvanized, zinc metalized or sheradized inside and out. The threaded ends of the conduit shall be zinc coated. Conduit fittings shall be zinc coated and shall be threaded type. Fittings shall be all steel. "Erikson" couplings shall be used where necessary. Running threads are not allowed. Connections shall be made with double locknuts except at threaded hubs. Terminations shall utilize insulated bushings.
- B. Thin wall conduit shall be Underwriter's approved galvanized electrical metallic tubing. Fittings for EMT shall be steel set screw or steel compression type. Connectors shall have insulated throats.
- C. Flexible Metal Conduit (Greenfield) shall be galvanized and conform to Federal Specification WW-C-566 and fittings shall conform to Federal Specification W-F-406, Type 1, Class 1. Liquid tight flexible conduit shall conform to NEC Article 350 as manufactured by Anamet, Thomas & Betts, or Electri-Flex. Fittings shall be as manufactured by Appleton, EFCor, or Thomas & Betts and conform to Federal Specification W-F-406, Type 1, Class 3.
- D. PVC conduit shall be schedule 40 or schedule 80, 90 degrees C UL listed, and UL listed for aboveground and underground uses. Conduit shall conform to NEMA TC-2 and UL-651 standards. All joints shall be solvent cemented in accordance with the recommendations of the manufacturer.
- E. Wireways and Auxiliary Gutters: Galvanized steel with removable covers unless indicated as hinged. Components shall be as manufactured by Square "D", Hoffman, Arlington, or Cooper B-Line.

2.2 Boxes and Accessories

- A. Sheet steel boxes and accessories shall conform to Federal Specification W-C-568; as manufactured by Appleton, Arlington, or Crouse-Hinds.
- B. Pull boxes and junction boxes larger than 4-11/16" shall be constructed of galvanized steel in accordance with NFPA-70, Article 314. Boxes shall be as manufactured by Hoffman, Appleton, Arlington, or Crouse-Hinds.

- B. Cast outlet boxes shall have threaded conduit entrances and gasketed covers. Boxes shall have a minimum of two hubs, unless noted otherwise.

Part 3 Execution

3.1 Raceways

- A. Rigid conduit shall be used for service laterals, in areas subject to physical damage, where run exposed, in damp or wet locations, in slabs and concrete and buried in earth.
- B. Paint metal conduits in or below ground floor slab or in ground with 2 coats of asphaltum up to 2" above finished floor slab inside the building or 6" above finished grade outside the building.
- C. Use flexible conduit for all connections to vibrating equipment such as motors, valves, and devices on piping and ductwork. Flexible conduit may be used for short connections to control devices, recessed fixtures, and similar items. The connection between structure and the first point of attachment to vibrating equipment shall be flexible. Machinery connections shall not exceed three feet. Fixture whips shall not exceed six feet and shall be supported from structure so as not to lay on ceiling tile.
- D. Use liquid-tight flexible conduit connections to all equipment in damp or wet locations.
- E. Electrical metallic tubing may be used for branch circuit wiring in areas above grade and within the building except in wet areas, slabs and as indicated otherwise.
- F. Install exposed conduit parallel with or at right angles to the building lines. Conduit in concrete shall be located so as not to affect the structural strength of the slabs as determined by the Structural Engineer. Conceal conduits in walls, above ceilings, in or under slabs or in furring, except in mechanical and electrical rooms and where indicated as exposed on existing walls. In areas with exposed structure and no finished ceiling, conduits shall be run as high as possible and held tight to walls or underside of roof.
- G. Changes in direction of runs shall be made with symmetrical bends or cast metal fittings. Field made bends and offsets shall be made with an approved conduit bending device. Damaged or deformed conduits shall not be installed. No bend shall exceed 90 degrees. Proper offsets shall be used to prevent strain on connectors at conduit termination points. All raceway runs shall be capped during the course of construction to prevent accumulation of dirt and debris. All conduits shall be cleared of all dirt and water before conductors may be pulled in.
- H. Schedule 40 PVC will be permitted where allowed by applicable codes and as outlined below. PVC may be used only in concrete and in earth and may not be used in wall or ceiling spaces. Exposed conduit in exterior locations shall be schedule 80. PVC may be used for service laterals if encased in a minimum of two inches of 3000 psi concrete.

All bends in PVC larger than 1" nominal trade size shall be made with rigid metal conduit. Penetrations through concrete slabs shall be made with rigid galvanized steel conduit.

- I. Aluminum conduit is not permitted in the ground or in slabs.
- J. ENT is not permitted.
- K. All raceway shall be supported at code required intervals with brackets and/or clamps as manufactured for conduit supports. Tie wire is not an acceptable means of support.

3.2 Boxes and Accessories

- A. Use fiberglass or stainless steel boxes with stainless steel hardware and gasketed covers for all exterior and for all damp locations, and for all exposed outlets.
- B. Boxes over two inches in width installed in stud walls shall be supported from two sides.
- C. All boxes shall be rigidly supported.
- D. Gangable type boxes shall not be used.
- E. Use masonry boxes in all block walls. At the individual cell where each box is located, fill the cell entirely with mortar. Switch boxes are not permitted in block walls.

3.3 Miscellaneous

- A. Provide approved fire stopping materials at all chases to prevent drafts.
- B. Provide expansion fittings in conduit runs crossing expansion joints in the structure.
- C. Fire Rating: Restore Fire Rating where piercing occurs through fire rated ceilings or between fire rated walls. Firestop material shall be as manufactured by 3M Company and UL listed for use in the construction assembly in which it is to be used. See architectural plans for locations of fire rated walls and ceilings.
- D. Provide 230 pound tensile strength polyolefin pull line in all empty conduits ½" to 1". Provide #14 gauge pullwire in all empty conduits over 1".

END OF SECTION

Part 1 General

1.1 General Requirements

- A. This section includes basic materials and methods for all of Division 26.

Part 2 Execution

2.1 Underground Service

- A. Service laterals shall run underground from the service disconnect to the pad mounted transformer.
- B. Conduit for service laterals shall be Schedule 40 PVC encased in a minimum of two inches of 3000 psi concrete.
- C. Where conduits for feeders pass through building foundations, provide rigid steel sleeves through the building foundation and extend to undisturbed earth on both sides of the foundation.
- D. A warning tape shall be installed 12" above conduits installed for service laterals, and underground feeders not covered by a concrete floor slab or encased in concrete.
- E. Conductors for service laterals shall be copper. Insulation shall be type THWN-2 or RHW-2. Conductors run in parallel shall be connected according to NEC 300.20 and 310.4. A minimum of 5 feet of slack shall be left in each conductor for power company connection at the transformer.

2.2 Metering

- A. The serving utility company shall govern the installation and connection of all metering. Contractor shall provide conduits and access for utility company use.
- B. Contractor shall install the meter enclosure and make all connections.

203 Primary Connections

- A. The service connections to the transformer will be made by the utility company, Gulf Coast Electric Cooperative (GCEC). The contractor shall coordinate power outage necessary for conductor pulling and conduit installation with the utility company.

- B. The primary cables will be furnished, installed, and connected by the local utility company.
- C. The contractor shall provide a steel reinforced concrete pad for mounting the utility company transformer. The pad shall be constructed according to details furnished by the utility company. Coordinate with GCEC and obtain an on-site inspection of the pad rough-in prior to pouring concrete.

2.4 Grounding:

- A. Provide grounding for the entire electrical installation as required by the N.E.C. and as specified herein.

END OF SECTION

Part 1 General Lighting and Distribution Transformers

1.1 Scope

- A. Furnish and install, as indicated on the electrical plans, dry-type transformers as manufactured by the Square D Company or approved equal.

Part 2 Products

2.1 Electrical Characteristics

- A. Three phase transformers shall be 480 volt delta primary and 208Y/120 volt secondary. Transformers 25 KVA and larger shall have a minimum of six 2-1/2% full capacity primary taps. Exact voltages and taps to be as designated on the plans or the transformer schedule.

2.2 Construction

- A. Transformers 15 KVA and above shall be 150 degrees C temperature rise above 40 degrees C ambient. All insulating materials to be in accordance with NEMA ST20 Standard for a 220 degrees C UL component recognized insulation system.
- B. Transformer coils shall be of the continuous wound construction and shall be impregnated with non-hygroscopic, thermosetting varnish.
- C. All cores to be constructed of high grade, non-aging silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point. The core laminations shall be clamped together with structural steel angles. The completed core and coil shall then be bolted to the base of the enclosure but isolated therefrom by means of rubber, vibration-absorbing mounts. There shall be no metal-to-metal contact between the core and coil and the enclosure. On transformers 500 KVA and smaller, the vibration isolating system shall be designed to provide a permanent fastening of the core and coil to the enclosure. Sound isolating systems requiring the complete removal of all fastening devices will not be acceptable.
- D. Transformers 15 KVA and larger shall be in a heavy gauge, sheet steel, ventilated enclosure. The ventilating openings of ventilated transformers shall be designed to prevent accidental access to live parts in accordance with UL, NEMA, and National Electrical Code standards for ventilated enclosures.
- E. The entire transformer enclosure shall be degreased, cleaned, phosphatized, primed, and finished with grey, baked enamel.
- F. The maximum temperature of the top of the enclosure shall not exceed 50 degrees C rise above a 40 degrees C ambient.

- G. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with applicable NEMA, IEEE, and ANSI standards.
- H. Sound levels shall be guaranteed by the manufacturer not to exceed the following: 15 to 50 KVA - 45DB; 51 to 150 KVA - 50DB; 151 to 300 KVA - 55DB; 301 to 500 KVA - 60DB
- I. Transformers located in exterior locations shall be NEMA 3R rated with coastal coating and protection.

2.3 Installation

- A. All transformers shall be mounted on 4" high reinforced concrete house-keeping pads extending 4" minimum beyond equipment on all sides.

Part 3 Execution

3.1 Prior Approval

- A. Suppliers asking consideration as an approved equal shall submit complete, guaranteed performance data and physical description for similar transformers. Data shall be submitted for each size specified and shall be received by the consulting engineer no less than 10 days prior to the bid due date for consideration.
- B. The transformer shall be listed by Underwriters' Laboratory for the specified temperature rise.

END OF SECTION

Part 1 General

1.1 Related Work Specified Elsewhere:

Safety Switches and Circuit Breakers.....Section 26 26 16

1.2 Submittals

- A. Submit shop drawings for approval on each panelboard indicating cabinet dimensions, component arrangements, characteristics, and sizes.

Part 2 Products

2.1 Panelboards for Lighting and Power

- A. Panels shall be standard dead front circuit breaker panels with main circuit breaker or main lugs as shown. Bus shall be copper or aluminum of ampere rating as shown arranged for voltage, phase and number of wires called for by the drawings. Front shall be complete with door and flush chrome plated lock and catch. Panels shall be flush or surface mounted as indicated. Proper trim shall be furnished for each panel. Branch circuit breakers shall be toggle type, quick make, quick break, thermal magnetic trip. All multi-pole breakers shall be single-handle, common trip type. Minimum AIC of circuit breakers shall be as indicated on the drawings.
- B. Directory shall be neatly typed and enclosed in plastic envelope on inside of panel door. The directory shall indicate the owner's room number or room name. Coordinate with final room identification plaques.
- C. Circuit breakers shall be arranged as indicated on the panel schedules on the drawings. Deviations shall be approved by the engineer and shall be documented on the as-built drawings.
- D. Panels shall be constructed of code gauge steel. Box shall be treated with a rust inhibitor. Front shall have gray finish over a rust inhibitor. Indoor units shall be NEMA 1 enclosure. Outdoor units shall be in weatherproof enclosure. All cabinet panels, closures, doors, structural frames and fasteners shall be coated, plated, and fabricated from rust resisting materials which will stand up under interior damp locations, or where outside will resist the elements of the weather and protect the interior parts.
- E. Locks on all panelboards shall be keyed alike. Provide a minimum of six keys to the owner's representative.
- F. Panelboards shall be factory assembled and tested. Circuit breaker panelboards shall be as manufactured by Square D, General Electric, Siemens, or Cutler-Hammer. Provide grounding terminal bus. Service equipment shall have Service Entrance Label.

- G. Where panels are placed in areas which may be used for storage, mark a rectangle on the floor in front of the panels with 3" wide yellow paint corresponding to the clearance required by the National Electrical Code. Fill the interior of the rectangle with diagonal 3" yellow stripes on 8" centers. Mark the interior of the rectangle with 3" black letters: "NO STORAGE". Coordinate with the owner's representative prior to painting any floor finish.
- H. Contractor shall coordinate with all trades to ensure space required by NEC 110.26 is maintained for all panelboards. The dedicated space extends from the floor to six feet above the equipment or to the structural ceiling (not a suspended ceiling) with a width and depth that of the equipment. No piping, ducts, or equipment foreign to the electrical equipment or architectural appurtenances shall be permitted to be installed in, enter, or pass through such spaces.
- I. All service entrance equipment and sub panels shall have UL 1449 fourth edition listed Surge Protection Devices (SPD's). UL voltage protection rating shall be as low as 600 volts for 120/208 volt panels and 1000 volts for 480 volt panels. Response time shall be less than 1.0 nanosecond. Main panel protection shall be equal to Advanced Protection Technologies TE/XDS20. Sub-panel protection shall be equal to Advanced Protection Technologies TE/XDS10. Provide flush mount trim for SPD units at flush mounted panelboards. Provide NEMA 4X enclosures for SPD units in exterior locations. Provide a separate thirty amp three pole circuit breaker in each panel for SPD connection. Leads between the SPD and circuit breaker shall be less than fifteen inches total length with no sharp bends and no bend over ninety degrees.
- J. All lugs and breaker terminals shall be rated at 75 degrees C.

END OF SECTION

Part 1 General

1.1 Related Work Specified Elsewhere

Panelboards.....Section 26 24 16

1.2 Submittals

- A. Submit shop drawings for approval including catalog cuts showing sizes types, and characteristics of all products.

Part 2 Products

2.1 Safety Switches

- A. Safety Switches shall be heavy-duty type unless specifically noted on the drawings. Fusible switches shall be provided with one-time cartridge or ferrule-type fuses of capacities shown on drawings. An extra set of fuses of each size shall be provided and turned over to the Owner. Fusible switches shall be 240 volt rated for the 208 volt system and 600 volt rated for the 480 volt system and shall be provided with general purpose enclosures unless noted otherwise. All switches for motors shall be horse-power rated. Fusible switches for motors shall be furnished with dual element fuses of the recommended size for the motor installed to provide motor running over current protection. Switches shall be labeled with black micarta tags engraved with white letters identifying component protected and power source. Tags shall be attached with machine screws or rivets.

2.2 Circuit Breakers, Molded Case

- A. Circuit breakers shall be of the ampere rating, voltage rating, number of poles and class or interrupting capacity (I.C.) as indicated. Contractor shall coordinate interrupting capacity with the serving utility company and the characteristics of their distribution system. Interrupting ratings are given in root mean square (RMS), symmetrical amperes based on NEMA test procedures. Lugs and terminals shall be UL approved for copper-aluminum.
- B. Each circuit breaker shall have a trip unit for each pole with elements providing inverse time delay under overload conditions and instantaneous magnetic trip for short circuit protection unless indicated as non-automatic. Trip elements shall operate a common trip bar to open all elements.
- C. Circuit breakers shall be bolt-on type or equal to Square D I-Line plug on type.
- D. The Service Disconnect shall be a molded case circuit breaker of the frame as indicated and/or service entrance rated, heavy duty, fused disconnect switch with fuses and enclosure type as indicated. Circuit breaker overload trip rating shall be as indicated.

Each pole of the breaker shall provide inverse time delay and instantaneous circuit protection. Breaker operator shall be a toggle handle to provide quick-make and quick-break operation. Handle shall be trip free.

- E. See Drawings for breaker sizes and interrupting ratings.
- F. Use HACR labeled breakers for heating and air conditioning loads.
- G. All breakers used on lighting circuits shall be switching duty rated.
- H. All breakers and safety switches shall have a 75 deg. C rating.

Part 3 Execution

3.1 Installation

- A. Mount grouped switches, disconnects, and controls on backboards or Unistrut.
- B. Generally, mount switches and disconnects between 4' and 5' up, readily accessible.

END OF SECTION

Part 1 Products

1.1 Wiring Devices

- A. All receptacles shall be the grounding type with ground connection made through an extra pole which shall be permanently connected to the raceway system.
- B. Receptacles for 120 volt circuits shall be rated for 20 Amperes minimum. Specification grade is required.
- C. Special receptacles shall be rated for amperage, voltage and have NEMA configuration as indicated or scheduled or shall be selected to meet the particular requirements. Coordinate selection with shop drawings and equipment to be furnished by the Owner.
- D. Toggle switches shall be heavy duty quiet type rated at 20 amperes 120/277 V AC only.
- E. Cover plates for damp location application shall have spring hinged covers to close automatically when not in use. Cover shall be of lexan or heavy duty die cast zinc and plated aluminum. Cover plates for wet location application shall have spring hinged covers and shall be listed as weatherproof while in use. Cover shall be of lexan or similar material.
- F. Cover plates on exposed boxes shall be steel.
- G. Interior plates shall be stainless steel.
- H. Device colors shall be gray.

Part 3 Execution

3.1 Outlets

- A. Install plates and covers on all outlets. Install all devices uniformly in each area.

3.2 Mounting

- A. Mounting heights (to center line of box): Generally, mount outlets 18" up unless otherwise noted. Mount Switches at 48" up. In block walls, boxes shall be located to be in only one block. Coordinate with architect prior to rough-in. In Wainscoting and tile walls, outlets shall be completely within or completely outside of Wainscoting or tile trim.
- B. Test each socket of each outlet with a device intended for the purpose.
- C. Devices shall be pulled up tight to outlet box. Device shall not be supported by cover plate.

- D. Outlet boxes recessed behind finished surfaces shall meet code requirements for maximum allowable distance between front of box and finished surface.
- E. Outlets mounted above counters shall be mounted horizontally 4" above the backsplash to the center of the device.
- F. Outlets shall be installed plumb within 1/16" from top to bottom.

END OF SECTION

Part 1 General

1.1 Scope

This Section includes the lighting fixtures, lamps, trim, ballasts, poles, bases, and accessories.

1.2 Qualifications

- A. Photometric data of independent, nationally recognized testing agencies will be accepted.
- B. Photometric data of testing laboratories of fixture manufacturers may be accepted if certified and approved by the Engineer.

1.3 Submittals

- A. Submit Shop Drawings for each fixture assembly consisting of catalog cuts, photometric data, dimensions, ballasts data, voltage, materials, finishes and installation data. Submittals shall be bound in a manual, indexed and identified in accordance with schedules. Submittal shall include point-point photometric analysis for site lighting.

1.4 Fixtures, General Requirements

- A. Light fixtures shall be furnished complete with lamps and all necessary mounting hardware and trim and installed as shown on the drawings.
- B. Light fixtures shall be neatly and firmly mounted, using standard supports for outlets and fixtures. Suitable support members shall be provided for all fixtures, outlet boxes and hangers under this section of specification.
- C. Except as indicated or specified otherwise, the metal parts of light fixtures shall be of corrosion-resistant metal or shall be suitably finished to resist corrosion; metal portions of fixtures which will be visible after installation shall have an unblemished finish.
- D. Lens frames shall be supported to avoid sagging and shall be readily removable with suitable hinges and latches. Removable frames shall have adequate retention for use when servicing.
- E. Plastic lens shall be made of heat-resistant acrylic. Minimum thickness shall be 0.125 inch.
- F. Emergency battery units shall have a five year unconditional warranty.
- G. Emergency lighting batteries installed in fixtures shall be sealed nickel cadmium battery units. The battery shall be maintenance free with special cell construction to withstand high temperatures.

The inverter shall be a highly efficient solid state inaudible high-frequency unit which will operate the lamp(s) in the emergency mode at approximately 10 watts. The unit will operate at 120 volts or 277 volts 60 Hz input with a maximum power draw of four watts. The unit shall automatically disconnect the normal fixture power and instantly energize the load upon power failure of the AC supply. Minimum emergency illumination time shall be 90 minutes. The emergency ballast shall be provided with self-testing electronic circuitry and shall automatically test emergency lighting for a minimum of 30 seconds every 30 days, and 90 minutes once a year. An embedded micro controller will continually monitor the battery charging current and voltage. An audible alarm and light-emitting diode shall be provided to indicate test results and status conditions.

Part 3 Execution

3.1 Installation

- A. Adjust directional fixtures to obtain the most uniform distribution. Orient all similar fixtures consistently. Coordinate fixtures with air grilles, pipes and ductwork.
- B. Fixture bottoms, edges, and ends shall be even. Clean all fixtures of debris and fingerprints and adjust trim to fit surfaces snug.
- C. Provide all necessary hangers and mounting accessories for a complete installation.
- D. Locate the fixture in the equipment rooms to best illuminate the equipment installed. Use chains or rods to support below ducts and pipes as required. Install after pipes and ducts are in.
- E. Test all fixtures, switches and controls for operation.

END OF SECTION

Part 1 General

1.1 Summary

- A. Work covered by this section of the specifications shall conform to the contract documents, engineering plans as well as state and local codes.
- B. The purpose of these specifications is to define the lighting system performance and design standards for Southport Park using an LED Lighting source. The manufacturer / contractor shall supply lighting equipment to meet or exceed the standards set forth in these specifications.
- C. The sports lighting will be for the following venues:
 - 1. Fields 1-6
- D. The primary goals of this sports lighting project are:
 - 1. **Guaranteed Light Levels:** Selection of appropriate light levels impact the safety of the players and the enjoyment of spectators. Light levels are guaranteed to not drop below specified target values for a period of 25 years.
 - 2. **Environmental Light Control:** It is the primary goal of this project to minimize spill light to adjoining properties and glare to the players, spectators and neighbors.
 - 3. **Cost of Ownership:** In order to reduce the operating budget, the preferred lighting system shall be energy efficient and cost effective to operate. All maintenance costs shall be eliminated for the duration of the warranty.
 - 4. **Control and Monitoring:** To allow for optimized use of labor resources and avoid unneeded operation of the facility, customer requires a remote on/off control system for the lighting system. Fields should be proactively monitored to detect luminaire outages over a 25-year life cycle. All communication and monitoring costs for 25-year period shall be included in the bid.

1.2 Lighting Performance

- A. **Illumination Levels and Design Factors:** Playing surfaces shall be lit to an average target illumination level and uniformity as specified in the chart below. Lighting calculations shall be developed and field measurements taken on the grid spacing with the minimum number of grid points specified below. Appropriate light loss factors shall be applied and submitted for the basis of design. Average illumination level shall be measured in accordance with the IESNA LM-5-04 (IESNA Guide for Photometric Measurements of Area and Sports Lighting Installations). Illumination levels shall not to drop below desired target values in accordance to IES RP-6-15, Page 2, Maintained Average Illuminance and shall be guaranteed for the full warranty period.

Area of Lighting	Average Target Illumination Levels	Maximum to Minimum Uniformity Ratio	Grid Points	Grid Spacing
Field 1 infield	50fc	2:1	25	30 x 30
Field 1 Outfield	30fc	2.5:1	86	30 x 30
Field 2 Infield	50fc	2:1	25	30 x 30
Field 2 outfield	30fc	2.5:1	86	30 x 30
Field 3 infield	50fc	2:1	25	30 x 30
Field 3 outfield	30fc	2.5:1	63	30 x 30
Field 4 Infield	50fc	2:1	25	20 x 20
Field 4 outfield	30fc	2.5:1	73	20 x 20
Field 5 infield	40fc	2:1	25	20 x 20
Field 5 outfield	30fc	2:1	6	20 x 20
Field 6 infield	50fc	2:1	25	20 x 20
Security	.95fc	-	1612	30 x 30

- B. Color: The lighting system shall have a minimum color temperature of 5700K and a CRI of 65+.
- C. Mounting Heights: To ensure proper aiming angles for reduced glare and to provide better playability, minimum mounting heights shall be as described below. Higher mounting heights may be required based on photometric report and ability to ensure the top of the field angle is a minimum of 10 degrees below horizontal.

# of Poles	Pole Designation	Pole Height
8	A1-A4, B1-B4	80'
9	C1-C6, P1	70'
3	A7,A8,C7	60'

1.3 ENVIRONMENTAL LIGHT CONTROL

- A. Light Control Luminaires: All luminaires shall utilize spill light and glare control devices including, but not limited to, internal shields, louvers and external shields. No symmetrical beam patterns are accepted.
- B. Lighting Ordinance: In accordance with Southport, Florida requirements

- C. Spill Light and Glare Control: To minimize impact on adjacent properties, spill light and candela values must not exceed the following levels taken at 3 feet above grade.

	Average	Maximum
Property Line Specified Spill Line Horizontal Footcandles not to exceed	.65 fc	7.5 fc
Candela at 100' outside of the property line not to exceed	1,100 cd	10,000 cd

- C. Spill Scans: Spill scans must be submitted indicating the amount of horizontal and vertical footcandles along the specified lines. Light levels shall be taken at 30-foot intervals along the boundary line. Readings shall be taken with the meter orientation at both horizontal and aimed towards the most intense bank of lights. Illumination level shall be measured in accordance with the IESNA LM-5-04 after 1 hour warm up.
- D. The first page of a photometric report for all luminaire types proposed showing horizontal and vertical axial candle power shall be provided to demonstrate the capability of achieving the specified performance. Reports shall be certified by a qualified testing laboratory with a minimum of five years experience or by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products. A summary of the horizontal and vertical aiming angles for each luminaire shall be included with the photometric report.

1.4 Cost of Ownership

- A. Manufacturer shall submit a 25 year Cost of Ownership summary that includes energy consumption, anticipated maintenance costs, and control costs. All costs associated with faulty luminaire replacement - equipment rentals, removal and installation labor, and shipping - are to be included in the maintenance costs.

Part 2 Product

2.2 Sports Lighting System Construction

- A. Manufacturing Requirements: All components shall be designed and manufactured as a system. All luminaires, wire harnesses, drivers and other enclosures shall be factory assembled, aimed, wired and tested.
- B. Durability: All exposed components shall be constructed of corrosion resistant material and/or coated to help prevent corrosion. All exposed carbon steel shall be hot dip galvanized per ASTM A123. All exposed aluminum shall be powder coated with high performance polyester or anodized. All exterior reflective inserts shall be anodized, coated, and protected from direct environmental exposure to prevent reflective degradation or corrosion.

All exposed hardware and fasteners shall be stainless steel, passivated and coated with aluminum-based thermosetting epoxy resin for protection against corrosion and stress corrosion cracking. Structural fasteners may be carbon steel and galvanized meeting ASTM A153 and ISO/EN 1461 (for hot dipped galvanizing), or ASTM B695 (for mechanical galvanizing). All wiring shall be enclosed within the cross-arms, pole, or electrical components enclosure.

- C. System Description: Lighting system shall consist of the following:
1. Galvanized steel poles and cross-arm assembly.
 2. Non-approved pole technology:
 - a. Square static cast concrete poles will not be accepted.
 - b. Direct bury steel poles which utilize the extended portion of the steel shaft for their foundation will not be accepted due to potential for internal and external corrosive reaction to the soils and long-term performance concerns.
 3. Lighting systems shall use concrete foundations. See Section 2.4 for details.
 - a. For a foundation using a pre-stressed concrete base embedded in concrete backfill the concrete shall be air-entrained and have a minimum compressive design strength at 28 days of 3,000 PSI. 3,000 PSI concrete specified for early pole erection, actual required minimum allowable concrete strength is 1,000 PSI. All piers and concrete backfill must bear on and against firm undisturbed soil.
 - b. For anchor bolt foundations or foundations using a pre-stressed concrete base in a suspended pier or re-enforced pier design pole erection may occur after 7 days. Or after a concrete sample from the same batch achieves a certain strength.
 4. Manufacturer will supply all drivers and supporting electrical equipment
 - a. Remote drivers and supporting electrical equipment shall be mounted approximately 10 feet above grade in aluminum enclosures. The enclosures shall be touch-safe and include drivers and fusing with indicator lights on fuses to notify when a fuse is to be replaced for each luminaire. Disconnect per circuit for each pole structure will be located in the enclosure. Integral drivers are not allowed.
 - b. Manufacturer shall provide surge protection at the pole equal to or greater than 40 kA for each line to ground (Common Mode) as recommended by IEEE C62.41.2_2002.
 5. Wire harness complete with an abrasion protection sleeve, strain relief and plug-in connections for fast, trouble-free installation.
 6. All luminaires, visors, and cross-arm assemblies shall withstand 150 mi/h winds and maintain luminaire aiming alignment.
 7. Contactor cabinet to provide on-off control.

8. Manufacturer shall provide lightning grounding as defined by NFPA 780 and be UL Listed per UL 96 and UL 96A.
 - a. Integrated grounding via concrete encased electrode grounding system.
 - b. If grounding is not integrated into the structure, the manufacturer shall supply grounding electrodes, copper down conductors, and exothermic weld kits. Electrodes and conductors shall be sized as required by NFPA 780. The grounding electrode shall be minimum size of 5/8 inch diameter and 8 feet long, with a minimum of 10 feet embedment. Grounding electrode shall be connected to the structure by a grounding electrode conductor with a minimum size of 2 AWG for poles with 75 feet mounting height or less, and 2/0 AWG for poles with more than 75 feet mounting height.
 9. Enhanced corrosion protection package: Due to the potentially corrosive environment for this project, manufacturers must provide documentation that their products meet the following enhanced requirements in addition to the standard durability protection specified above:
 - a. Exposed carbon steel horizontal surfaces on the crossarm assembly shall be galvanized to no less than a five (5) mil average thickness
 - b. Exposed die cast aluminum components shall be Type II anodized per MIL-STD-8625 and coated with high performance polyester.
 - c. Exposed extruded aluminum components shall be Type II anodized per MIL-STD-8625 and coated with high performance polyester.
- D. Safety: All system components shall be UL listed for the appropriate application.

2.2 Electrical

- A. Electric Power Requirements for the Sports Lighting Equipment:
 1. Electric power: 480 Volt, 3 Phase
 2. Maximum total voltage drop: Voltage drop to the disconnect switch located on the poles shall not exceed three (3) percent of the rated voltage.
- B. Energy Consumption: The kW consumption for the field lighting system shall be 197.93 kW.

2.3 Control

- A. Instant On/Off Capabilities: System shall provide for instant on/off of luminaires.
- B. Lighting contactor cabinet(s) constructed of NEMA Type 4 aluminum, designed for easy installation with contactors, labeled to match field diagrams and electrical design. Manual off-on-auto selector switches shall be provided.

- C. Dimming: System shall provide for 3-stage 4-stage dimming (high-medium-low-blackout). Dimming will be set via scheduling options (Website, app, phone, fax, email) or via an onsite user interface tablet or device.
- D. Remote Lighting Control System: System shall allow owner and users with a security code to schedule on/off system operation via a web site, phone, fax or email up to ten years in advance. Manufacturer shall provide and maintain a two-way TCP/IP communication link. Trained staff shall be available 24/7 to provide scheduling support and assist with reporting needs.
- E. The owner may assign various security levels to schedulers by function and/or fields. This function must be flexible to allow a range of privileges such as full scheduling capabilities for all fields to only having permission to execute "early off" commands by phone. Scheduling tool shall be capable of setting curfew limits.
- F. Controller shall accept and store 7-day schedules, be protected against memory loss during power outages, and shall reboot once power is regained and execute any commands that would have occurred during outage.
- G. Remote Monitoring System: System shall monitor lighting performance and notify manufacturer if individual luminaire outage is detected so that appropriate maintenance can be scheduled. The controller shall determine switch position (manual or auto) and contactor status (open or closed).
- H. Management Tools: Manufacturer shall provide a web-based database and dashboard tool of actual field usage and provide reports by facility and user group. Dashboard shall also show current status of luminaire outages, control operation and service. Mobile application will be provided suitable for IOS, Android and Blackberry devices.
- I. Hours of Usage: Manufacturer shall provide a means of tracking actual hours of usage for the field lighting system that is readily accessible to the owner.
 - 1. Cumulative hours: shall be tracked to show the total hours used by the facility
 - 2. Report hours saved by using early off and push buttons by users.
- J. Communication Costs: Manufacturer shall include communication costs for operating the control and monitoring system for a period of 25 years.
- K. Communication with luminaire drivers: Control system shall interface with drivers in electrical components enclosures by means of powerline communication wireless communication.

2.4 Structural Parameters

- A. Wind Loads: Wind loads shall be based on the 2020 Florida Building Code. Wind loads to be calculated using ASCE 7-10, an ultimate design wind speed of 140.
- B. Pole Structural Design: The stress analysis and safety factor of the poles shall conform to AASHTO 2013 Standard Specification for Structural Supports for Highway Signs, Luminaires, and Traffic Signals (LTS-6).

- C. Foundation Design: The foundation design shall be based on soil parameters as outlined in the geotechnical report.

Part 3 Execution

3.1 SOIL QUALITY CONTROL

- A. It shall be the Contractor's responsibility to notify the Owner if soil conditions exist other than those on which the foundation design is based, or if the soil cannot be readily excavated. Contractor may issue a change order request / estimate for the Owner's approval / payment for additional costs associated with:
 1. Providing engineered foundation embedment design by a registered engineer in the State of Florida for soils other than specified soil conditions;
 2. Additional materials required to achieve alternate foundation;
 3. Excavation and removal of materials other than normal soils, such as rock, caliche, etc.

3.2 Delivery Timing

- A. Delivery Timing Equipment On-Site: The equipment must be on-site 8-12 weeks from receipt of approved submittals and receipt of complete order information.

3.3 Field Quality Control

- A. Illumination Measurements: Upon substantial completion of the project and in the presence of the Contractor, Project Engineer, Owner's Representative, and Manufacturer's Representative, illumination measurements shall be taken and verified. The illumination measurements shall be conducted in accordance with IESNA LM-5-04.
- B. Field Light Level Accountability
 1. Light levels are guaranteed not to fall below the target maintained light levels for the entire warranty period of 25 years. These levels will be specifically stated as "guaranteed" on the illumination summary provided by the manufacturer.
 2. The contractor/manufacturer shall be responsible for conducting initial light level testing and an additional inspection of the system, in the presence of the owner, one year from the date of commissioning of the lighting.
 3. The contractor/manufacturer will be held responsible for any and all changes needed to bring these fields back to compliance for light levels and uniformities. Contractor/Manufacturer will be held responsible for any damage to the fields during these repairs.
- C. Correcting Non-Conformance: If, in the opinion of the Owner or his appointed Representative, the actual performance levels including footcandles and uniformity ratios are not in conformance with the requirements of the performance specifications and submitted information, the Manufacturer shall be required to make adjustments to meet specifications and satisfy Owner.

3.4 Warranty and Guarantee

- A. 25-Year Warranty: Each manufacturer shall supply a signed warranty covering the entire system for 25 years from the date of shipment. Warranty shall guarantee specified light levels. Manufacturer shall maintain specifically-funded financial reserves to assure fulfillment of the warranty for the full term. Warranty does not cover weather conditions events such as lightning or hail damage, improper installation, vandalism or abuse, unauthorized repairs or alterations, or product made by other manufacturers.
- B. Maintenance: Manufacturer shall monitor the performance of the lighting system, including on/off status, hours of usage and luminaire outage for 25 years from the date of equipment shipment. Parts and labor shall be covered such that individual luminaire outages will be repaired when the usage of any field is materially impacted. Manufacturer is responsible for removal and replacement of failed luminaires, including all parts, labor, shipping, and equipment rental associated with maintenance. Owner agrees to check fuses in the event of a luminaire outage.

Part 4 Design Approval

4.0 PRE-BID SUBMITTAL REQUIREMENTS (Non-Musco)

- A. Design Approval: The owner / engineer will review pre-bid submittals per section 4.0.B from all the manufacturers to ensure compliance to the specification 10 days prior to bid. If the design meets the design requirements of the specifications, a letter and/or addendum will be issued to the manufacturer indicating approval for the specific design submitted.
- B. Approved Product: Musco's Light-Structure System™ with TLC for LED™ is the approved product. All substitutions must provide a complete submittal package for approval as outlined in Submittal Information at the end of this section at least 10 days prior to bid. Special manufacturing to meet the standards of this specification may be required. An addendum will be issued prior to bid listing any other approved lighting manufacturers and designs.
- C. All listed manufacturers not pre-approved shall submit the information at the end of this section at least 10 days prior to bid. An addendum will be issued prior to bid; listing approved lighting manufacturers and the design method to be used.
- D. Bidders are required to bid only products that have been approved by this specification or addendum by the owner or owner's representative. Bids received that do not utilize an approved system/design, will be rejected.

REQUIRED SUBMITTAL INFORMATION FOR ALL MANUFACTURERS (NOT PRE-APPROVED) 10 DAYS PRIOR TO BID

*All items listed below are mandatory, shall comply with the specification and be submitted according to pre-bid submittal requirements. Complete the Yes/No column to indicate compliance (Y) or noncompliance (N) for each item. **Submit checklist below with submittal.***

Ye s/ No	Tab	Item	Description
	A	Letter/ Checklist	Listing of all information being submitted must be included on the table of contents. List the name of the manufacturer's local representative and his/her phone number. Signed submittal checklist to be included.
	B	Equipment Layout	Drawing(s) showing field layouts with pole locations
	C	On Field Lighting Design	Lighting design drawing(s) showing: <ol style="list-style-type: none"> a. Field Name, date, file number, prepared by b. Outline of field(s) being lighted, as well as pole locations referenced to the center of the field (x & y), Illuminance levels at grid spacing specified c. Pole height, number of fixtures per pole, horizontal and vertical aiming angles, as well as luminaire information including wattage, lumens and optics d. Height of light test meter above field surface. e. Summary table showing the number and spacing of grid points; average, minimum and maximum illuminance levels in foot candles (fc); uniformity including maximum to minimum ratio, coefficient of variance (CV), coefficient of utilization (CU) uniformity gradient; number of luminaires, total kilowatts, average tilt factor; light loss factor.
	D	Off Field Lighting Design	Lighting design drawing showing initial spill light levels along the boundary line (defined on bid drawings) in footcandles. Lighting design showing glare along the boundary line in candela. Light levels shall be taken at 30-foot intervals along the boundary line. Readings shall be taken with the meter orientation at both horizontal and aimed towards the most intense bank of lights.
	E	Photometric Report	Provide first page of photometric report for all luminaire types being proposed showing candela tabulations as defined by IESNA Publication LM-35-02. Photometric data shall be certified by laboratory with current National Voluntary Laboratory Accreditation Program or an independent testing facility with over 5 years experience.
	F	Performance Guarantee	Provide performance guarantee including a written commitment to undertake all corrections required to meet the performance requirements noted in these specifications at no expense to the owner. Light levels must be guaranteed to not fall below target levels for warranty period.
	G	Structural Calculations	Pole structural calculations and foundation design showing foundation shape, depth backfill requirements, rebar and anchor bolts (if required). Pole base reaction forces shall be shown on the foundation drawing along with soil bearing pressures. Design must be stamped by a structural engineer in the state of Florida, if required by owner.
	H	Control & Monitoring System	Manufacturer of the control and monitoring system shall provide written definition and schematics for automated control system. They will also provide ten (10) references of customers currently using proposed system in the state of Florida.

I	Electrical Distribution Plans	Manufacturer bidding an alternate product must include a revised electrical distribution plan including changes to service entrance, panels and wire sizing, signed by a licensed Electrical Engineer in the state of Florida.
J	Warranty	Provide written warranty information including all terms and conditions. Provide ten (10) references of customers currently under specified warranty in the state of Florida.
K	Project References	Manufacturer to provide a list of 10 projects where the technology and specific fixture proposed for this project has been installed in the state of Florida. Reference list will include project name, project city, installation date, and if requested, contact name and contact phone number.
L	Product Information	Complete bill of material and current brochures/cut sheets for all product being provided.
M	Delivery	Manufacturer shall supply an expected delivery timeframe from receipt of approved submittals and complete order information.
N	Non-Compliance	Manufacturer shall list all items that do not comply with the specifications. If in full compliance, tab may be omitted.
O	Cost of Ownership	Document cost of ownership as defined in the specification. Identify energy costs for operating the luminaires. Maintenance cost for the system must be included. All costs should be based on 25 Years
P	Environmental Light Control Design	Environmental glare impact scans must be submitted showing the maximum candela on a map of the surrounding area until 500 candela or less is achieved.

The information supplied herein shall be used for the purpose of complying with the specifications for Southport Park. By signing below I agree that all requirements of the specifications have been met and that the manufacturer will be responsible for any future costs incurred to bring their equipment into compliance for all items not meeting specifications and not listed in the Non-Compliance section.

Manufacturer: _____

Signature: _____

Contact Name: _____

Date: ____/____/____

Contractor: _____

Signature:

END OF SECTION

Part 1 General

1.1 Contractor Qualifications

- A. The Structured Cabling System Contractor shall be an experienced firm regularly engaged in the layout and installation of structured cabling systems of similar size and complexity as required for this installation. The Structure Cabling Contractor, under the same company name, shall have successfully completed the layout, installation, testing and warranty of not less than five Structured Cabling Systems of the scope of the largest system on this project for a minimum period of three years prior to the bid date, and shall have been regularly engaged in the business of Structure Cabling System contracting continuously since. The Contractor shall have an existing permanent office located within 200 miles of the job site from which installation and warranty service operations will be performed.
- B. Structure Cabling System Contractor shall present, in his submittal, the name and certification number of a BICSI certified Cable Installer who will be in charge of cable installation and testing. The Cable Installer shall have overall responsibility for certifying that the installed structured cabling system conforms to these contract documents and to the referenced EIA/TIA, IEEE, BICSI, and UL standards.
- C. The Cable Installer shall sign off on all cable test results, indicating that he was in responsible charge of all cable testing procedures and that all cables were tested in compliance with the contract documents and met or exceeded the requirements stated therein.

1.2 Submittal Requirements

- A. The Structure Cabling System Contractor shall provide the following documentation, to be presented with the submittal, as evidence that the requirements for Structure Cabling System Contractor qualifications listed above are satisfied.
- B. If the bidder does not meet the requirements of this specification section for structured cabling system work, he shall provide the following documentation as evidence that the requirements listed above are satisfied by the Structure Cabling System Contractor he proposes to use as a subcontractor to perform work under this section. In either case, all work under this section shall be performed by permanent employees of the Structure Cabling System Contractor listed in the submittal, and shall not be performed by another subcontractor, employees of another company, or by temporary employees.
 - 1. A list of not less than five (5) references for jobs of similar size and complexity including project name, location, contact person and phone number.
 - 2. Cable Installer name, BICSI certification number, and qualifications.
 - 3. Location of office from which installation and warranty work will be performed.

1.3 Related Requirements

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.
- B. Section 26 00 00 "General Electrical", applies to this section, with the additions and modifications specified herein and on the drawings.
- C. Conduit and raceways shall be provided under Division 26. The contractor shall be responsible for coordination with the electrical contractor for specific locations and requirements.

1.4 Description of Work

- A. The work consists of all labor, materials, equipment, and services necessary to provide, install, test, and certify a new structured cabling system as described in the contract documents.

1.5 Quality Assurance

- A. Materials shall be new and shall be the best of their respective kinds. All work shall be accomplished in a workmanlike manner in keeping with the best practices and highest standards of the telecommunications industry. Protect materials and equipment from physical or environmental damage during shipping, storage, and installation. Equipment and materials shall be received at the site in new condition and shall be maintained in new condition throughout the installation process. Damaged or deteriorated equipment and materials will not be acceptable.
- B. The Contractor shall be responsible for the safety and condition of all materials and equipment, whether stored or installed, until final acceptance by the Engineer and the Owner. All materials and equipment shall be UL listed for the intended application.

Part 2 Products

2.1 Materials and Equipment, General

- A. All materials, equipment, and devices shall, as a minimum, meet the requirements of UL where UL standards are established for those items, and the requirements of NFPA 70.
- B. All like items of material or equipment shall be the same product of the same manufacturer.
- C. All materials and equipment shall be a standard catalogued products of a manufacturer regularly engaged in the manufacture of similar products.

2.2 Product Specifications

- A. See contract drawings for all product requirements not indicated in these specifications

Part 3 Execution

3.1 Installation

- A. The installation shall be in strict accordance with all applicable codes and standards, the respective manufacturer's written recommendations, and the contract drawings and these specifications.
- B. All materials, equipment, and devices shall be new and unused, of current manufacture and of the highest grade, free from defects. Workmanship shall be of the highest grade in accordance with modern practice. The installed system shall be neat, clean, and well organized in appearance.
- C. Route cabling in conduit and wireway as indicated. Do not pull cables in conduits until plastic insulating bushings have been installed. Cables installed in conduits without plastic insulating bushings shall be removed and replaced with new cables.
- D. The Contractor, in providing a bid for the system in accordance with the contract documents, agrees to install all cabling in the conduit and wireway paths specified. The Contractor shall be fully responsible for any and all damage to cabling which may occur during the installation and shall replace any damaged cabling with new cabling of the type specified for the application.
- E. All labels shall be produced using a laser printer and shall be easily readable from floor level when viewing a backboard, panel, or communications outlet from the front. Handwritten labels are not acceptable. Provide data sheets describing proposed labeling products for cable and conduit with pre-installation submittals. Label each cable at each end based on room number and destination telcom room number using write-on mylar wrap wire markers.

3.2 System Verification and Acceptance

- A. Contractor's Cable Installer shall be in responsible charge of all cable testing procedures and shall provide a letter to the Engineer at the completion of successful testing certifying that all cables have been tested in compliance with the contract documents and have met or exceed the requirement stated therein.
- B. The requirement for this project is full compliance/zero tolerance. Cables which do not comply shall be removed and replaced. Partial use of cables by claiming good pairs or strands and abandoning others is not allowable.
- C. Tests shall be performed in strict accordance with the test instrument manufacturer's printed instructions.

- D. Technicians performing testing shall be thoroughly trained in the use of the test instruments employed. Factory certification of technicians is desirable. The Contractor shall provide evidence of training if requested.
- E. Test instruments shall meet the approval of the Engineer for accuracy, stability, and general suitability for the test performed.
- F. The Contractor shall be required to retest installed cables in the Engineer's presence to verify the Contractor's test documentation. The percentage of cables to be retested shall be determined by the Engineer based on compliance of the installation with the contract documents, quality of workmanship, and results of initial cable retests. Retesting shall be performed as required until all cables comply with the requirements of the contract documents.

3.3 Category 5e/6 UTP Cable Testing

- A. After installation and termination of the Category 5e/6 TP cable, test each cable in accordance with TIA/EIA TSB 67. Test each conductor for end-to-end continuity and for correct termination on a pin-by-pin basis.
- B. Test each cable from both ends with a Category 5e/6 tester, Microtest Penta Scanner+ with Microtest 2-Way Injector+, to verify compliance with TIA/EIA specifications for Category 5e/6 UTP, "Basic Link" configuration, Level II accuracy, with no allowable deviation. Test at the full range of frequencies indicated by TIA/EIA. Use the tester manufacturer's 2-way injector to measure near-end crosstalk (NEXT) and attenuation-to-crosstalk (ACR) from both ends of each cable. Make connections at each end using access cables provided by the tester manufacturer.

3.4 Warranty

- A. The installed structured cabling system shall be guaranteed against defects in materials and installation for a period of three years from the date of acceptance by the Engineer. The services of a qualified technician shall be available to make necessary warranty repairs in a timely manner during the warranty period.

END OF SECTION

Part 1 General

1.1 Scope

- A. This section includes providing conduit, boxes, jacks, plates, cables, cable terminations, and backboards.

Part 2 - Products

2.1 Boxes and Conduit

- A. Provide in accordance with Section 26 05 33.
- B. Provide structured media center equal to Leviton 47604-F6S in each unit. Provide a patch panel to accommodate the number of cables installed, typically two ports per bedroom plus two spare ports.

2.2 WIRING

- A. Wiring for Data and cable television outlets shall be provided, installed, and tested by the contractor.
- B. Television system cable shall be type RG-6 as shown on the plans. Cables shall be as manufactured by Belden or West Penn Wire. Contractor shall install cables, jacks, and plates.
- C. Wiring for data outlets shall consist of four pair UTP 24 AWG copper category 5e cables. One cable per bedroom is required from the Building Communications Room to each structured media center plus one spare cable per unit. Provide cat 5e jumpers in each patch panel between each service port and bedroom port.
- D. Provide plenum rated cables where required by the local authority having jurisdiction.

2.3 Outlets

- A. Jacks and faceplates for Data and television outlets shall be provided and installed by the contractor. Faceplates shall match wiring device plates in style and color.
- B. Cable television jacks shall be type F connectors.
- C. Data jacks shall be RJ-45 category 5e or category 6 type. Contractor shall provide terminations and testing.

Part 3 Execution

3.1 Installation

- A. Minimum size outlet box shall be four inch square with device ring as required by the wiring devices. Coordinate with Owner's representative.
- B. Provide bushings on the ends of cut conduits. Conduits may be PVC underground as allowed by section 16130.
- C. Provide testing and certification of all data cables.
- D. Conform to Telephone Company and cable service provider requirements.
- E. Provide a #6 ground to all backboards and terminals boxes from the building grounding electrode system. Ground wire need not be in a raceway.
- F. Provide #14 TW pull wire or 230 lb. test Polyolefin pull line in all empty conduits.
- G. Provide as a minimum one 3" PVC conduits from the data/com backboard to the property line at a location indicated by the local telephone company. See data/com riser diagram for additional conduit requirements for the telephone service entrance.
- H. Provide as a minimum two 3" PVC conduits from the data/com backboard to the property line at a location indicated by the local cable service provider. See data/com riser diagram for additional conduit requirements for the cable television service entrance.
- I. Provide as a minimum two 3" PVC conduits from the data/com backboard to the property line at a location indicated by the local internet service provider. See data/com riser diagram for additional conduit requirements for the cable television service entrance.
- J. Each cable shall be identified on each end. Coordinate labeling scheme with owner's representative prior to installation.
- K. Data cables shall be terminated by the contractor utilizing either TIA-586A or TIA-586B. Contractor shall pick one method that will be the standard throughout the project.
- L. Data cables shall be tested by the contractor and test results for each cable documented. Cables that fail to pass shall be replaced, re-terminated, and re-tested.

END OF SECTION

Part 1 General

1.1 Work Included

- A. Provide labor, materials, equipment and incidentals necessary to perform operations in connection with clearing, grubbing, and disposal of cleared and grubbed materials.

1.2 Definitions

- A. Interfering or Objectionable Material: Trash, rubbish, and junk; vegetation and other organic matter, whether alive, dead, or decaying; topsoil.
- B. Clearing: Removal of interfering or objectionable material lying on or protruding above ground surface.
- C. Grubbing: Removal of vegetation and other organic matter including stumps, buried logs, and roots greater than 2 inches caliper to a depth of 6 inches below subgrade.
- D. Scalping: Removal of sod without removing more than upper 3 inches of topsoil.
- E. Stripping: Removal of topsoil remaining after applicable scalping is completed.
- F. Project Limits: Areas, as shown or specified, within which Work is to be performed.

1.3 Submittals

- A. Submit work plan in accordance with local requirements.
- B. The limits of clearing, grubbing, and stripping are defined in Section 3.3 and detailed on the project plans.

1.4 Quality Assurance

- A. Obtain Owner's approval of staked clearing, grubbing, and stripping limits, prior to commencing clearing, grubbing, and stripping.

1.5 Scheduling and Sequencing

- A. Prepare site only after adequate erosion and sediment controls and tree protection fencing are in place. Limit areas exposed uncontrolled to erosion during installation of temporary erosion and sediment controls.

Part 2 Products

(NOT USED)

Part 3 Execution

3.1 General

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Clear, grub, and strip areas actually needed for staging area or site improvements within limits shown or specified. Do not injure or deface vegetation that is not designated for removal.

3.2 Preparation

- A. Mark areas to be cleared and grubbed and areas to be undisturbed prior to commencing clearing operations. The Owner shall approve clearing and grubbing limits prior to commencement of clearing operations.
- B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place. Excavate for, and remove, underground utilities indicated to be removed.
 - 1. Arrange with utility owners to shut-off indicated utilities.
- C. Trees, shrubs, and other existing undisturbed areas outside of the clearing limits, which are within 10' of the clearing limits, shall be clearly marked to avoid damage during clearing and grubbing operations.
- D. Remove trees and brush outside the clearing limits, but within the immediate vicinity of the work, upon receipt of approval by the Owner, when the trees or brush interfere with the progress of construction operations.
- E. Clearly mark trees and shrubs within the clearing limits, which are to remain, and protect the trees and shrubs from damage during the clearing and grubbing operations as noted on drawings.
- F. The clearing limits shall not extend beyond the project limits.

3.3 Limits

- A. As follows, but not to extend beyond Project limits.
 - 1. Excavation Including Trenches: 5 feet beyond top of cut slopes.
 - 2. Fill:
 - a. Clearing and Grubbing: 5 feet beyond toe of permanent fill.
 - b. Stripping and Scalping: 5 feet beyond toe of permanent fill.

3. Staging Area:
 - a. Clearing: 5 feet beyond perimeter.
 - b. Scalping and Stripping: As shown.
 - c. Grubbing: Around perimeter as necessary for neat, finished appearance.
4. Other Areas: As shown.

- B. Remove rubbish, trash, and junk from entire area within project limits.

3.4 Clearing

- A. Clear areas within limits of construction.
- B. Fell trees so that they fall away from facilities and vegetation not designated for removal.
- C. Cut stumps not designated for grubbing flush with ground surface.
- D. Cut off shrubs, brush, weeds, and grasses to within 2 inches of ground surface.

3.5 Site Improvements

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
 2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.6 Grubbing

- A. Grub areas within limits of construction.

3.7 Scalping

- A. Do not remove sod until after clearing and grubbing is completed and resulting debris is removed.
- B. Scalp areas within limits shown or specified.

3.8 Stripping

- A. Do not remove topsoil until after scalping is completed.
- B. Strip areas within limits to minimum depths shown or specified. Do not remove subsoil with topsoil.
- C. Stockpile strippings, meeting requirements of Section 31 20 00 – Earth Moving for topsoil, separately from other excavated material.

3.9 Tree Removal Outside Clearing Limits

- A. Remove Trees Within Project Limits:
 - 1. Dead, dying, leaning, or otherwise unsound trees that may strike and damage Project facilities in falling.
 - 2. Trees designated by Owner for removal.
- B. Remove stumps and debris, and if disturbed, restore surrounding area to its original condition.

3.10 Pruning

- A. Remove branches below the following heights: 20 feet above proposed ground level.
- B. Prune as indicated in local ordinances and the tree protection plans.

3.11 Salvage

- A. Saleable logs timber may be sold to Contractor's benefit. Promptly remove from Project site.
- B. Sod with commercial value may be sold to Contractor's benefit. Promptly remove from Project site.

3.12 Disposal

- A. Clearing and Grubbing Debris:
 - 1. Dispose of debris offsite.
 - 2. Burning of debris onsite will not be allowed.
 - 3. Woody debris may be chipped. Chips may be sold to Contractor's benefit or used for landscaping onsite as mulch or uniformly mixed with topsoil, provided that resulting mix will be fertile and not support combustion. Maximum dimensions of chipped material used onsite shall be 1/4-inch by 2 inches.

Dispose of chips that are unsaleable or unsuitable for landscaping or other uses with chipped debris.

4. Limit offsite disposal of clearing and grubbing debris to locations that are approved by federal, state, and local authorities, and that will not be visible from Project.
- B. Scalpings: As specified for clearing and grubbing debris.
- C. Strippings:
1. Dispose of strippings that are unsuitable for topsoil or that exceed quantity required for topsoil offsite.
 2. Stockpile topsoil in sufficient quantity to meet Project needs. Dispose of excess strippings as specified for clearing and grubbing.
- D. Completely remove timber, logs, roots, brush, rotten wood, and other refuse from the Owner's property. Disposal of materials in streams shall not be permitted and no materials shall be piled in stream channels or in areas where it might be washed away by floods. Timber within the area to be cleared shall become the property of the Contractor, and the Contractor may cut, trim, hew, saw, or otherwise dress felled timber within the limits of the Owner's property, provided timber and waste material is disposed of in a satisfactory manner. Materials shall be removed from the site daily unless permission is granted by the Owner to store the materials for longer periods.

END OF SECTION

Part 1 General

1.1 Scope

- A. This Section includes earthwork and related operations, including, but not limited to, excavating all classes of material, handling, storage, transportation and disposal of all excavated and unsuitable or excess material, construction of fill material areas, placing and replacing fill materials around structures and pipe, placing and replacing fill materials for all trenches and pits, compacting, all sheeting, shoring and bracing, preparation of subgrades, finished grading, and any other similar, incidental, or appurtenant earthwork operations which may be necessary to properly complete the work.
- B. The Contractor shall provide all services, labor, materials, and equipment required for all earthwork and related operations, necessary or convenient to the Contractor, for furnishing complete work as shown on the Drawings or specified in these Contract Documents.
- C. Earthwork within public rights-of-way shall be done in accordance with requirements and provisions of the permits issued by those agencies for the construction within their respective rights-of-way. Where such requirements and provisions are present, the strictest requirement shall govern.
- D. Excavation work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the work, regardless of the type, character, composition, or condition of the material.

1.2 Existing Information

- A. The elevations shown on the Drawings as existing are taken from existing data and are intended to give reasonably accurate information about the existing elevations. They are not precise, and the Contractor shall become satisfied as to the exact quantities of excavation and fill required.

1.3 Quality Assurance

- A. Approval Required: All earthwork materials shall be subject to the approval of the Owner's on-site Geotechnical Engineer.
- B. Tests for compaction and density shall be conducted by the Owner's on-site Geotechnical Engineer (an independent testing laboratory).
 - 1. The soils testing laboratory is responsible for the following:
 - a. Field compaction testing shall be based on using the maximum dry density determined by the Standard Proctor Compaction Test in accordance with ASTM D 698 or the Modified Proctor Compaction Test in accordance with ASTM D 1557 as noted on the drawings.

- b. Maximum dry density for non-cohesive materials shall mean the maximum index density as determined by the "Maximum Index Density of Soils Using a Vibratory Table", ASTM D 4253.
 - c. Determination of in-place fill material density shall be done in accordance with ASTM D 1556, "Density of Soil in Place by the Sand Core Method", ASTM D 2937, "Density of Soil in Place by the Drive-Cylinder Method" or ASTM D 6938, "In-Place Density/Water Content of Soil/Soil Aggregate by Nuclear Methods Shallow Depth".
 - d. Complete a minimum of one (1) field density test per fifty (50) linear feet of continuous wall footing and one (1) density test per isolated column footing. Also, a minimum of one (1) field density test for each two hundred (200) linear feet for each foot of vertical thickness of fill in utility trenches. One (1) field density test for each 1,500 square feet of existing soils and for each foot of fill soils.
 - e. Inspecting and testing of stripped site, subgrades, and proposed fill materials.
 - f. Testing of pavement subgrades in accordance with FDOT specifications.
2. Contractor's duties relative to testing include:
- a. Notifying laboratory of conditions requiring testing.
 - b. Coordinating with laboratory for field testing.
 - c. Providing representative fill material soil samples to the laboratory for test purposes. Provide 50-pound samples of each fill soil.
3. Inspection
- a. Earthwork operations, suitability of excavated fill materials, and placing and compaction of fill materials are subject to inspection. Owner's on-site Geotechnical Engineer will observe earthwork operations.
 - b. Foundations and shallow spread footing foundations are required to be reviewed by the Owner's on-site Geotechnical Engineer to verify suitable bearing and construction.
- C. All earthwork operations shall comply with the requirements of OSHA Construction Standards, Part 1926, Subpart P, Excavations, Trenching, and Shoring, and Subpart O, Motor Vehicles, Mechanized Equipment, and Marine Operations, and shall be conducted in a manner acceptable to the Owner's on-site Geotechnical Engineer.
- D. It is understood and agreed that the Contractor has made a thorough investigation of the surface and subsurface conditions of the site and any special construction problems which might arise as a result of nearby watercourses and floodplains,

particularly in areas where construction activities may encounter water-bearing sands and gravels, or limestone solution channels. The Contractor shall be responsible for providing all services, labor, equipment, and materials necessary or convenient to the Contractor for completing the work within the time specified in these Contract Documents.

Part 2 Products

2.1 Fill Materials

A. Fill Material, General

1. Approval Required: All fill material shall be subject to the approval of the Owner's on-site Geotechnical Engineer. Both moisture and density will be evaluated for compliance herein.
2. Notification: For approval of imported fill material, notify the Owner's on-site Geotechnical Engineer and testing laboratory at least one week in advance of intention to import material, designate the proposed borrow area, and permit testing as necessary to prove the quality of the material.
3. Engineered fill shall be free of organics, organic laden sands, rubble, clay balls, and other deleterious materials and shall be as follows:
 - a. Building/Pavilion foundations: Material used to raise the building areas to finished grade shall be sands to slightly silty sands containing no more than 12% by dry weight finer than the U.S. No. 200 mesh sieve. Fill material shall be placed in thin level lifts not to exceed twelve (12) inches loose measure and thoroughly compacted to at least 95% of the Modified Proctor maximum dry density (ASTM D1557).
 - b. Pavement Areas: Material used to raise the pavement areas to finished grade shall be sands to slightly silty sands (non-plastic) containing no more than 12% by dry weight finer than the U.S. No. 200 mesh sieve. Fill material shall be placed in thin level lifts not to exceed twelve (12) inches loose measure and thoroughly compacted to at least 95% of the Modified Proctor maximum dry density (AASHTO T-180). The top twelve (12) inches of subgrade soils shall be stabilized to achieve a Limerock Bearing Ratio of 40.

B. Unclassified Excavation

1. All material excavated on site shall be considered unclassified unless otherwise indicated herein.
2. Measurement and Payment
 - a. All Unclassified Excavation unit price items are to be measured in cubic yards (CY) on an in-situ basis prior to excavation by means of surveyed

crosssections before and after excavation. Unclassified Excavation pay item includes excavation, transport, placement, and compaction, and all associated labor and equipment costs. Survey data shall be collected by a licensed land surveyor and submitted to the Engineer as a hard copy with a PLS seal and in CAD, landXML, TIN, or other approved digital format.

C. Imported Fill Material

1. Material meeting the definition of Engineered fill brought from offsite sources shall be considered Imported Fill Material.
2. Measurement and Payment
 - a. All Imported Fill Material unit price items are to be measured in cubic yards (CY) on an in-situ basis by means of surveyed crosssections. Imported Fill Material pay item includes excavation, transport, placement, and compaction, and all associated labor and equipment costs.
 - b. Crosssections shall be taken before and after placement and compaction to determine volume. Survey data shall be collected by a licensed land surveyor and submitted to the Engineer as a hard copy with a PLS seal and in CAD, landXML, TIN, or other approved digital format.

2.2 Aggregate

- A. Coarse Aggregate or Crushed Stone: Coarse aggregate shall conform to the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition.
- B. Fine Aggregate: All fine aggregate shall conform to the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition.

2.3 Topsoil

- A. Topsoil is defined as the top layer of soil and should consist of dark organic weed free loam, free of muck.

2.4 Construction Materials

- A. Sheeting, Bracing and Timbering: The Contractor shall furnish, place, and maintain all sheeting, bracing and timbering required to properly support trenches and other excavations in open cut and to prevent all movement of the soil, pavement, structures, or utilities outside of the trench or pit.
 1. General

- a. Cofferdams and bracing design, including computations, shall be prepared before commencing construction operations. Drawings and design computations shall be signed and sealed by a registered professional engineer licensed in the state in which the Project is located. The Drawings and design computations shall not be submitted to the Engineer.
 - b. Sheeting, bracing and timbering shall be so placed as to allow the work to be constructed to the lines and grades shown on the Drawings.
 - c. If at any time the method being used by the Contractor for supporting any material or structure in or adjacent to any excavation is not reasonably safe, the Contractor shall provide additional bracing and support necessary to furnish the added degree of safety.
 - d. All sheeting in contact with the concrete or masonry shall be cut off.
2. Timber: Timber may be substituted for steel sheet piling when approved by the City. Timber for shoring, sheeting, or bracing shall be sound and free of large or loose knots, and in good condition. Size and spacing shall be in accordance with OSHA regulations.
 3. Steel Sheet Piling: Steel sheet piling shall be the continuous interlock type. The weight, depth, and section modulus of the sheet piling shall be sufficient to restrain the loads of earth pressure and surcharge from existing foundations and/or live loads. Procedure for installation and bracing shall be so scheduled and coordinated with the removal of the earth that the ground under existing structures shall be protected against lateral movement at all times. The Contractor shall provide closure and sealing between sheet piling and existing facilities. Steel piling within three feet of an existing building, structure or pipeline shall remain in place, unless otherwise directed by the City.
 4. Remove bracing and sheeting in units when fill material reaches the point necessary to protect the structures and adjacent property. Leave sheeting in place when, in the opinion of the City, it cannot be safely removed. Cut off sheeting left in place at least two feet below the surface.

2.5 Other Materials

- A. All other materials not specifically described but required for proper completion of the work of this Section shall be as selected by the Contractor subject to the approval of the Architect and Owner.

Part 3 Execution

3.1 General

- A. Safety: Comply with local regulations and with the provisions of the "Manual of Accident Prevention in Construction" of the Associated General Contractors of

America, Inc., Occupational Safety and Health Act and all other applicable safety regulations.

- B. Earthwork operations shall be performed in a safe and proper manner with appropriate precautions being taken against all hazards.
- C. All excavated and filled areas for structures, trenches, fills, topsoil areas, embankments, and channels shall be maintained by the Contractor in good condition at all times until final acceptance by the Owner. All damage caused by erosion or other construction operations shall be repaired by the Contractor using material of the same type as the damaged material.
- D. The Contractor shall control grading in a manner to prevent surface water from running into excavations. Obstruction of surface drainage shall be avoided and means shall be provided whereby storm water flow can be uninterrupted in existing gutters, other surface drains, or temporary drains. Free access must be provided to all fire hydrants, meters, and other areas and utilities that may need to be accessed.
- E. Topsoil
 - 1. Remove all topsoil to the full layer depth and at which depth the subsoil is encountered, from all areas under buildings, pavements, and from all areas which are to be cut to lower grades or filled.
 - 2. With the Owner's approval, topsoil to be used for finish grading may be stored on the site.
 - 3. Properly dispose of all excess topsoil off site.
- F. Bracing and Sheeting
 - 1. Furnish, put in place, and maintain all sheeting, bracing, and shoring as may be required to properly support the sides of all excavations and to prevent all movement of earth which could in any way injure the work, adjacent property, or workers.
 - 2. Properly support all excavations in locations indicated on the Drawings and where necessary to conform to all pertinent rules and regulations and these Specifications, even though such locations are not indicated on the Drawings.
 - 3. Exercise care in the removal of sheeting, shoring, bracing and timbering to prevent collapse or caving of the excavation faces being supported and damage to the work and adjacent property.
 - 4. Do not leave any sheeting or bracing in the trench or excavation after completion of the work, unless approved by the Owner.
- G. Obstructions

1. Remove and dispose of all trees, stumps, roots, boulders, sidewalks, driveways, pavement, pipes, and the like, as required for the performance of the work.
2. Exercise care in excavating around catch basins, inlets, and manholes so as to not disturb or damage these structures.
3. Avoid removing or loosening castings or pushing dirt into catch basins, inlets, and manholes.
4. Damaged or displaced structures or castings shall be repaired or replaced and dirt entering the structures during the performance of the work shall be removed at no additional cost to the Owner.

H. Utilities to be Abandoned or Removed

1. When pipes, conduits, sewers, or other structures are removed from the trench, leaving dead ends in the ground, such ends shall be fully plugged or sealed with brick and non-shrink grout.
2. Abandoned structures such as manholes or chambers shall be entirely removed unless otherwise specified or indicated on the Drawings.
3. All materials from abandoned utilities which can be readily salvaged shall be removed from the excavation and stored on the site at a location as directed by the Owner.

I. All salvageable materials will remain the property of the Owner unless otherwise indicated by the Owner.

J. Cutting Paved Surfaces and Similar Improvements

1. Remove existing pavement as necessary for installing pipe utilities and appurtenances or as otherwise shown on the Drawings.
2. Before removing any pavement, mark the pavement neatly, paralleling pipelines and existing street lines. Space the marks the width of the trench.
3. Saw cut asphalt pavement along the marks to create a smooth line.
4. Do not pull pavement with machines until completely saw cut and separated from pavement to remain.
5. Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement. No additional payment will be made for removing and replacing damaged adjacent pavement.
6. Remove and replace sidewalks disturbed by construction for their full width and to the nearest undisturbed joint.

7. The Contractor may tunnel under curbs that are encountered. Remove and replace any curb disturbed by construction to the nearest undisturbed joint.

3.2 Excavation

A. Method

1. All excavation shall be by open cut from the surface except as indicated on the Drawings.
2. All excavations for pipe appurtenances and structures shall be made in such a manner, and to such depth and width, as will give ample room for building the structures, and for bracing, sheeting, and supporting the sides of the excavation, for pumping and draining groundwater which may be encountered, and for the removal from the excavation of all materials excavated.
3. Take special care so that the soil below the bottom of the structure to be built is left undisturbed unless otherwise noted herein.

B. Grades: Excavate to grades indicated on the Drawings. Where excavation grades are not indicated on the Drawings, excavate as required to accommodate installation.

C. Disposal of Excavated Material

1. Remove and properly dispose off-site all excavated material not needed to complete filling, backfilling, and grading.

D. Dispose of excess excavated fill material in accordance with all requirements of federal, state, county, and municipal regulations. No debris of any kind shall be deposited in any stream or body of water, or on any street or alley. No debris shall be deposited on any private property, except by written consent of the property owner. In no case shall any debris material be left on the Project, shoved onto abutting private properties, or be buried in embankments or trenches on the Project.

E. Dispose of all other excavated and unsuitable materials including but not limited to soil that does not meet the requirements of this Section at off-site locations secured by the Contractor and in accordance with all requirements of federal, state, county, and municipal regulations. No debris of any kind shall be deposited in any stream or body of water, or on any street or alley. No debris shall be deposited on any private property, except by written consent of the property owner. In no case shall any material be left on the Project, shoved onto abutting private properties, or be buried in embankments or trenches on the Project.

F. Extra Earth Excavation

1. If soft or excessively wet material which, in the opinion of the Owner's on-site Geotechnical Engineer is not suitable for construction, is encountered below the final subgrade elevation of an excavation or underneath a structure, the Owner's on-site Geotechnical Engineer may order the removal of this material

- and its replacement with crushed stone or other suitable material in order to make a suitable foundation for the construction of the structure.
2. All extra excavation made at the order of the Owner's on-site Geotechnical Engineer will be paid for on the basis of the actual volume of the excavation as measured by the Engineer. No measurement for payment shall be made until all dewatering has been successfully accomplished.

3.3 Excavating for Structures

- A. Prior to the placement of fill material and following the removal of cut material all areas shall be examined by the Owner's onsite geotechnical engineer. This examination shall include proof rolling with construction equipment, test pits, supplemental test bores, visual examinations, etc. as needed to determine the presence and extent of any unsuitable materials or conditions. Areas which exhibit weak soil or unsuitable conditions shall be corrected as noted herein.
- B. This Article applies to all structures except as modified in Article 3.7.
- C. Earth Excavation: Earth excavation shall include all substances to be excavated other than rock.
 1. All organics, organic laden sands, organic soils, or deleterious materials shall be removed prior to the placement of fill material. Prior to the placement of fill soils, the existing soils shall be compacted until a density of 95% of the Modified Proctor (ASTM D1557) maximum dry density is achieved to a depth of twelve (12) inches below existing grade. Moisture conditioning of the soils may be required to achieve optimum moisture conditions for compaction as to be determined by the Owner's onsite Geotechnical Engineer. Once footings are excavated, the existing soils at the bottom of the footing shall be compacted until a density of 95% of the Modified Proctor (ASTM D1557) maximum dry density is achieved to a depth of twelve (12) inches below the bottom of footings.
 2. Any existing underground utilities within building areas shall be removed and the trenches shall be backfilled with compacted suitable fill soils and tested in accordance with specifications herein.
 3. Any soft or yielding areas encountered shall be observed by the Owner's onsite Geotechnical Engineer. If yielding conditions are due to shallow groundwater, appropriate means shall be incorporated to lower the groundwater to a moisture condition where the soils are workable. If the soft conditions are encountered with unsuitable soils, the unsuitable soils shall be over excavated and replaced with dry suitable soils as specified herein.
 4. Prior to foundation construction, clear and grub the surface soils within building areas and at least five (5) feet beyond to remove all topsoil, organic laden sands, and other deleterious materials.

- D. Excavation for Foundations: Foundations and slabs-on-grade shall rest on compacted materials to ensure proper bearing.
- E. Excavations for pavements: Prior to construction, clear and grub the surface soils within pavement areas and at least five (5) feet beyond to remove all topsoil, organic laden sands, and other deleterious materials.
- F. Pipe Trenches Beneath Structures: Where piping or conduit passes beneath footings or slabs resting on grade, trenches shall be excavated to provide a minimum 6-inch clearance from all surfaces of the pipe or conduit. The trench shall be backfilled to the base of the structure or as shown on the Drawings.
- G. Unauthorized Excavation: Care shall be taken that excavation does not extend below bottom levels of foundations or slabs on earth or rock. Should the excavation be carried below such levels, the Contractor shall fill in the resulting excess excavation with concrete under foundations and compacted graded aggregate or other material approved by the Owner's on-site Geotechnical Engineer under slabs-on-grade. Should excavation be carried beyond outside lines of footings, such excess excavation shall be filled with concrete, or formwork shall be provided, as directed by the Owner's on-site Geotechnical Engineer.
- H. Unsuitable Bearing
 - 1. If suitable bearings for foundations as directed by the Owner's on-site Geotechnical Engineer are not encountered at the elevations indicated on the Drawings, immediately notify the Owner's on-site Geotechnical Engineer.
 - 2. Do not proceed further until instructions are received and necessary measurements made for purposes of establishing additional volume of excavation.

3.4 Compaction

- A. Fill materials supporting roadways, parking areas, sidewalks, structures, and buildings and placed around structures above undisturbed earth shall be compacted as noted herein.
- B. Compaction of fill materials around structures shall be accomplished by heavy power tamping equipment.
- C. If tests indicate that density of fill material is less than that specified, the area shall be either recompacted or undercut, replaced with fill material, and compacted until specified density is achieved.

3.5 Placing Fill Materials

- A. Controlled Fill

1. The fill material placed for roadways, parking areas, walks, structures, and building slabs-on-grade shall be known as controlled fill material.
 2. After the existing ground or excavated area has been proofrolled and examined by the Owner's on-site Geotechnical Engineer, all holes and other irregularities shall be filled and compacted before the main fill material is placed.
- B. The fill material shall be placed in even layers and shall be thoroughly compacted as herein specified.
- C. If an analysis of the soil being placed shows a marked difference from one location to another, the fill being placed shall not be made up of a mixture of these materials.
- D. Each different type of material shall be handled continuously so that field control of moisture and density may be based upon a known type of material.
- E. No fill shall be placed following a heavy rain without first making certain on isolated test areas that compaction can be obtained without damage to the already compacted fill.
- F. Proofrolling
1. All areas where roadways, parking areas, sidewalks, structures, and buildings are to be constructed on cut areas, compacted fill material areas, and other areas where indicated on the Drawings, shall be proofrolled to detect soft spots prior to and following placement of fill materials.
- G. Proofrolling shall be witnessed by the Owner's on-site Geotechnical Engineer.
- H. Conduits, pipes, culverts, and underdrains shall be neither disturbed nor damaged by proofrolling operations. Rollers shall neither pass over, nor approach closer than five feet to, conduits, pipes, culverts, and underdrains unless the tops of those utilities are deeper than three feet.

3.6 Grading

- A. General: Perform all rough and finish grading required to attain the elevations indicated on the Drawings. Perform finish grading to an accuracy of 1/4-inch.
- B. Compact backfill underlying roadways, parking areas, sidewalks, structures, and buildings in accordance with Article 3.4 of this Section.
- C. Backfilling around structures shall be performed in accordance with Article 3.6 of this Section.
- D. Treatment After Completion of Grading
1. After grading is completed, permit no further excavation, filling or grading, except with the approval of the Owner's on-site Geotechnical Engineer.

2. Use all means necessary to prevent the erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

3.7 Surface Water Control

- A. Regulations and Permits: Obtain all necessary soil erosion control permits in accordance with Florida Department of Environmental Protection rules and all pertinent rules, laws, and regulations of all applicable federal, state, county, and municipal regulatory agencies.
- B. Unfavorable Weather: Do not place, spread, or roll any fill material during unfavorable weather conditions. Do not resume operations until moisture content and fill density are satisfactory to the Owner's on-site Geotechnical Engineer.
- C. Provide berms or channels to prevent flooding of subgrade. Promptly remove all water collected in depressions.
- D. Pumping and Drainage
 1. Provide, maintain, and use at all times during construction adequate means and devices to promptly remove and dispose of all water from every source entering the excavations or other parts of the work.
 2. Dewater by means which will ensure dry excavations, preserve final lines and grades, do not disturb or displace adjacent soil.
 3. All pumping and drainage shall be performed with no damage to property or structures and without interference with the rights of the public, owners of private property, pedestrians, vehicular traffic, or the work of other contractors, and in accordance with all pertinent laws, ordinances, and regulations.
 4. Do not overload or obstruct existing drainage facilities.

3.8 Settlement

- A. The Contractor shall be responsible for all settlement of backfill, fills and embankments which may occur within one year after final acceptance of the work by the Owner.
- B. The Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after receipt of written notice from the Architect or Owner.

3.9 Cleaning

- A. Upon completion of the work of this Section, remove all rubbish, trash, and debris resulting from construction operations. Remove surplus equipment and tools. Leave the site in a neat and orderly condition acceptable to the Owner.

END OF SECTION

Part 1 General

1.01 Section Includes

- A. Excavating for footings, pile caps, slabs-on-grade, paving, site structures, and utilities within the building.
- B. Trenching for utilities outside the building.

Part 2 Products

NOT USED

Part 3 Execution

3.01 Examination

- A. Verify that survey bench mark and intended elevations, for the work, are as indicated.

3.02 Preparation

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate, identify, and protect utilities that remain and protect from damage.
- C. Notify utility company to remove and relocate utilities as required.
- D. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.03 Excavating

- A. Underpin adjacent structures that could be damaged by excavating work.
- B. Excavate to accommodate new structures and construction operations.
- C. Notify Engineer of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.
- D. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
- E. Do not interfere with 45 degree bearing splay of foundations.
- F. Cut utility trenches wide enough to allow inspection of installed utilities.
- G. Hand trim excavations. Remove loose matter.

Excavation

- H. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 31 23 23.
- I. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- J. Stockpile excavated material to be re-used in area designated on site.
- K. Remove excess excavated material from site.

3.04 Protection

- A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

END OF SECTION

Part 1 General

1.1 Section Includes

- A. Section includes construction dewatering. Contractor shall be responsible for dewatering system during construction.

1.2 Related Sections:

1. Section 31 11 00 – Clearing and Grubbing
2. Section 31 20 00 – Earth Moving

1.3 Submittals

- A. Submit work plan in accordance with City Requirements.
- B. Shop Drawings: For dewatering system, prepared by or under the supervision of a qualified professional engineer.
 1. Include plans, elevations, sections, and details.
 2. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.
 3. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
 4. Include written plan for dewatering operations including sequence of well and well-point placement coordinated with excavation shoring and bracings and control procedures to be adopted if dewatering problems arise.
- C. Qualification Data: For installer.
- D. Field quality-control reports.
- E. Existing Conditions: Using photographs, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by dewatering operations. Submit before Work begins.
- F. Record Drawings: Identify locations and depths of capped wells and well points and other abandoned-in-place dewatering equipment.

1.4 Quality Assurance

- A. Installer Qualifications: An experienced installer that has specialized in dewatering work.

1.5 Field Conditions

- A. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from this data.
1. Make additional test borings and conduct other exploratory operations necessary for dewatering according to the performance requirements.
 2. Due to above average annual rainfall, the contractor shall employ a Professional Land Surveyor licensed in Florida to obtain the groundwater elevations prior to excavations at the site. The information shall be provided to the Owner and the Owner's onsite geotechnical engineer.

Part 2 Products

2.1 Performance Requirements

- A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
1. Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer.
 2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, prevention of flooding in excavation, and prevention of damage to subgrades and permanent structures.
 3. Prevent surface water from entering excavations by grading, dikes, or other means.
 4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
 5. Remove dewatering system when no longer required for construction unless otherwise instructed by Owner.
 6. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with water- and debris-disposal regulations of authorities having jurisdiction.

Part 3 Execution

3.1 Preparation

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
 - 1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site or surrounding area.
 - 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Provide temporary grading to facilitate dewatering and control of surface water.
- D. Protect and maintain temporary erosion and sedimentation controls, which are specified in other applicable sections of these specifications, during dewatering operations.

3.2 Installation

- A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
 - 1. Space well points or wells at intervals required to provide sufficient dewatering.
 - 2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
- B. Place dewatering system into operation to lower water to specified levels before excavating below ground-water level.
- C. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

- D. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails.

3.3 Operation

- A. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.
- B. Operate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
 - 1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
 - 2. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
 - 3. Maintain piezometric water level a minimum of 24 inches below bottom of excavation.
- C. Dispose of water and sediment removed in conformance with local requirements. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.
- D. Remove dewatering system from Project site on completion of dewatering if required. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

3.4 Field Quality Control

- A. Observation Wells: Provide observation wells or piezometers, take measurements, and maintain at least the minimum number indicated; additional observation wells may be required by authorities having jurisdiction.
 - 1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.
 - 2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.

3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.
- B. Survey-Work Benchmarks: Resurvey benchmarks regularly during dewatering and maintain an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Owner and Engineer if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.
- C. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.
- D. Prepare reports of observations.

3.5 Protection

- A. Protect and maintain dewatering system during dewatering operations.
- B. Promptly repair damages to adjacent facilities caused by dewatering.
 1. Dispose of strippings that are unsuitable for topsoil or that exceed quantity required for topsoil offsite.
 2. Stockpile topsoil in sufficient quantity to meet Project needs. Dispose of excess strippings as specified for clearing and grubbing.

END OF SECTION

Part 1 General

1.01 Section Includes

- A. Filling, backfilling, and compacting for footings, slabs-on-grade, paving, site structures, and utilities within the building.
- B. Backfilling and compacting for utilities outside the building.
- C. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

Part 2 Products

2.01 Fill Materials

- A. General Fill - Fill Type Structural and Non-Structural: Shall conform to the requirements of the project geotechnical report.
- B. Concrete for Fill: Lean Concrete
- C. Granular Fill - Fill Type Structural and Non-Structural: Coarse aggregate, shall conform to the requirements of project geotechnical report.
- D. Sand - Fill Type Structural and Non-Structural: Shall conform to the requirements of the project geotechnical report.

2.02 Accessories

- A. Geotextile Fabric: Non-biodegradable, woven, as specified in the project geotechnical report.
- B. Vapor Retarder: 10 mil thick, polyethylene.

Part 3 Execution

3.01 Examination

- A. Identify required lines, levels, contours, and datum locations.
- B. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.
- C. Verify structural ability of unsupported walls to support imposed loads by the fill.
- D. Verify underground tanks are anchored to their own foundations to avoid flotation after backfilling.

3.02 Preparation

- A. Scarify subgrade surface to a depth of 6 inches to identify soft spots.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with structural fill in areas where foundations will bear. In other areas, general fill will be acceptable.
- C. Compact subgrade to density equal to or greater than requirements required by the project geotechnical report.
- D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 Filling

- A. Fill to contours and elevations indicated using unfrozen materials.
- B. Employ a placement method that does not disturb or damage other work.
- C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- D. Maintain optimum moisture content of fill materials as described in the project geotechnical report to attain required compaction density.
- E. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.
- F. Soil Fill: Place and compact material in equal continuous layers not exceeding 6 inches compacted depth.
- G. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- H. Correct areas that are over excavated.
 - 1. Load-bearing foundation surfaces: Use structural fill, flush to required elevation, compacted to the requirements of the project geotechnical report.
 - 2. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.
- I. Compaction density unless otherwise specified or indicated on the drawings or in the project geotechnical report shall be:
 - 1. Under paving, slabs-on-grade, and similar construction: 97 percent of maximum dry density.
- J. Reshape and re-compact fills subjected to vehicular traffic.

3.04 Field Quality Control

- A. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D3017, or ASTM D6938.
- B. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 ("standard Proctor"), ASTM D 1557 ("modified Proctor"), or AASHTO T 180.
- C. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- D. Frequency of Tests: 1 test per 500 square feet.
- E. Proof roll compacted fill at surfaces that will be under slabs-on-grade and paving.

END OF SECTION

Part 1 General

1.1 Section Includes

- A. Clearing and grubbing.
- B. Excavation and disposal of all wet and dry materials (including rock) encountered that must be removed for construction purposes.
- C. Sheeting, shoring, bracing, and timbering.
- D. Dewatering of trenches and other excavations.
- E. Pipe bedding.
- F. Backfilling and tamping of trenches, foundations, and other structures.

1.2 Definitions

- A. Degree of Compaction: Degree of compaction is expressed as a percentage of the maximum density obtained by the test procedure for general soil types, abbreviated as percent laboratory maximum density.
- B. Hard Materials: Weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" but which usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.
- C. Rock: Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement.

1.3 Submittals

- A. The following shall be submitted in accordance with City's submittal requirements:
- B. Test Reports – Submit copies of all laboratory and field test reports within 24 hours of the completion of the test.
 - 1. Borrow Site Testing: Fill and backfill test.
 - 2. Select material test.
 - 3. Porous fill test for capillary water barrier.
 - 4. Density tests.

5. Moisture Content Tests.

1.4 Delivery, Storage, and Handling

- A. Perform in a manner to prevent contamination or segregation of materials.

1.5 Requirements for Off Site Soil

- A. Soils brought in from off site for use as backfill shall be tested for petroleum hydrocarbons, BTEX, PCBs and HW characteristics (including toxicity, ignitability, corrosivity, and reactivity). Backfill shall not contain concentrations of these analytes above the appropriate State and/or EPA criteria, and shall pass the tests for HW characteristics. Determine petroleum hydrocarbon concentrations by using appropriate State protocols. Determine BTEX concentrations by using EPA SW-846.3-3 Method 5035/8260B. Perform complete TCLP in accordance with EPA SW-846.3-3 Method 1311. Perform HW characteristic tests for ignitability, corrosivity, and reactivity in accordance with accepted standard methods. Perform PCB testing in accordance with accepted standard methods for sampling and analysis of bulk solid samples. Provide borrow site testing for petroleum hydrocarbons and BTEX from a grab sample of material from the area most likely to be contaminated at the borrow site (as indicated by visual or olfactory evidence), with at least one test from each borrow site. For each borrow site, provide borrow site testing for HW characteristics from a composite sample of material, collected in accordance with standard soil sampling techniques. Do not bring material onsite until tests results have been received and approved by the Owner.
- B. Reference Section 31 20 00 for additional off-site soil requirements.

1.6 Field Measurements

- A. Verify that survey benchmark and intended elevations for the Work are as shown on the drawings.

1.7 Coordination

- A. Verify work associated with lower elevation utilities is complete before placing higher elevation utilities.

1.8 Quality Assurance

- A. Utilities: Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor's risk. Perform work adjacent to non-Owner utilities as indicated in accordance with procedures outlined by utility company. Excavation made with power-driven equipment is not permitted within two (2) feet of known utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand or in accordance with utility guidelines. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing

work affected by the contract excavation until approval for backfill is granted by the utility company. Report damage to utility lines or subsurface construction immediately to the City.

Part 2 Products

2.1 Soil Materials

- A. Satisfactory Materials: Any materials classified by ASTM D2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, or SP, free of debris, roots, wood, scrap material, vegetation, refuse, soft unsound particles, and frozen, deleterious, or objectionable materials. Unless specified otherwise, the maximum particle diameter shall be one-half the lift thickness at the intended location.
- B. Unsatisfactory Materials: Materials which do not comply with the requirements for satisfactory materials. Unsatisfactory materials also include man-made fills, trash, refuse, or backfills from previous construction. Unsatisfactory material also includes material classified as satisfactory which contains root and other organic matter, frozen material, and stones larger than two (2) inches. The City shall be notified of any contaminated materials.
- C. Backfill and Fill Material: Provide ASTM D2321 materials in accordance with utility or City requirements.
- D. Topsoil: Provide as specified on Landscape Plans.

2.2 Utility Bedding Material

- A. Provide ASTM D2321 materials in accordance with utility or City requirements.

2.3 Borrow

- A. Obtain borrow materials required in excess of those furnished from excavations from sources outside of Owner's property.

2.4 Buried Warning and Identification Tape

- A. Warning Tape for All Piping: If any, will be as outlined in pertinent design plans (e.g., irrigation, site lighting, etc.).
- B. Tracer Wire for Non-Metallic Piping: Shall be in accordance with City requirements.

Part 3 Execution

3.1 Protection

- A. Shoring and Sheeting

1. Take special care to avoid damage wherever excavation is being done. Sufficiently sheet, shore, and brace the sides of all excavations to prevent slides, cave-ins, settlement, or movement of the banks and to maintain the specified trench widths. Use solid sheets in wet, saturated, or flowing ground. All sheeting, shoring, and bracing shall have enough strength and rigidity to withstand the pressures exerted, to keep the walls of the excavation properly in place, and to protect all persons and property from injury or damage. Separate payment will not be made for sheeting, shoring, and bracing, which are considered an incidental part of the excavation work.
2. Wherever employees may be exposed to moving ground or cave-ins, shore and lay back exposed earth excavation surfaces more than 5 feet high to a stable slope, or else provide some equivalent means of protection. Effectively protect trenches less than 5 feet deep when examination of the ground indicates hazardous ground movement may be expected. Guard the walls and faces of all excavations in which employees are exposed to danger from moving ground by a shoring system, sloping of the ground, or some equivalent protection.
3. Trench excavation safety protection shall be accomplished as required by the most recent provisions of Part 1926, Subpart P - Excavations, Trenching, and Shoring of the Occupational Safety and Health Administration (OSHA) Standards and Interpretations, as may be amended. Comply with all OSHA standards in determining where and in what manner sheeting, shoring, and bracing are to be done. If necessary, the sheeting, shoring, and bracing system shall be designed by a professional engineer licensed in the State of Florida and shall be subject to approval by the City. However, such approval does not relieve the Contractor of the sole responsibility for the safety of all employees, the effectiveness of the system, and any damages or injuries resulting from the lack or inadequacy of sheeting, shoring, and bracing.
4. Where excavations are made adjacent to existing buildings or structures or in paved streets or alleys, take particular care to sheet, shore, and brace the sides of the excavation so as to prevent any undermining of or settlement beneath such structures or pavement. Underpin adjacent structures wherever necessary, with the approval of the City.
5. Do not leave sheeting, shoring, or bracing materials in place unless this is called for by the Drawings, ordered by the City, or deemed necessary or advisable for the safety or protection of the new or existing work or features. Remove these materials in such a manner that the new structure or any existing structures or property, whether public or private, will not be endangered or damaged and that cave-ins and slides are avoided.
6. Fill and compact all holes and voids left in the work by the removal of sheeting, shoring, or bracing as specified herein.
7. The Contractor may use a trench box, which is a prefabricated movable trench shield composed of steel plates welded to a heavy steel frame. The trench

box shall be designed to provide protection equal to or greater than that of an appropriate shoring system.

8. A "Qualified Person", as defined by OSHA regulations, shall be on-site at all times during activities requiring trench safety provisions.

B. Drainage and Dewatering

1. Provide for the collection and disposal of surface and subsurface water encountered during construction.
2. Drainage: So that construction operations progress successfully, completely drain construction site during periods of construction to keep soil materials sufficiently dry. Contractor to provide positive surface water runoff away from the construction activity and/or provide temporary swales and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site, the area immediately surrounding the site, and the area affecting operations at the site shall be continually and effectively drained.
3. Dewatering:
 - a. Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches, or trenches will not be permitted within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in-situ material. While the excavation is open, the water level shall be maintained continuously, at least 2 feet below the working level.

C. Underground Utilities

1. Location of the existing utilities indicated is approximate. The Contractor shall physically verify the location and elevation of all existing utilities prior to starting construction. The Contractor shall contact the Florida 811 and affected utilities for assistance in locating existing utilities.

D. Machinery and Equipment: Movement of construction machinery and equipment over pipes during construction shall be at the Contractor's risk. Repair, or remove

and provide new pipe for existing or newly installed pipe that has been displaced or damaged.

3.2 Surface Preparation

- A. Clear and grub project area in accordance with Section 31 11 00 - Clearing and Grubbing.
- B. Identify required lines, levels, contours, and datum.
- C. Protect plant life, lawns, and other features remaining as part of final landscaping.
- D. Maintain and protect above and below grade utilities which are to remain.

3.3 Excavation

- A. Excavate to contours, elevation, and dimensions indicated. Reuse excavated materials that meet the specified requirements for the material type required at the intended location. Keep excavations free from water. Excavate soil disturbed or weakened by Contractor's operations, soils softened or made unsuitable for subsequent construction due to exposure to weather. Excavations below indicated depths will not be permitted except to remove unsatisfactory material.
- B. Wherever muck, quicksand, soft clay, swampy ground, or other unsuitable material is encountered, remove it and continue excavation until suitable material is encountered. The material removed shall be disposed of in the manner described below. Then refill the areas excavated for this reason with crushed stone up to the level of the lines, grades, and/or cross sections shown on the Drawings.
- C. Unless specified otherwise, refill excavations cut below indicated depth with satisfactory material and compact to 95 percent of ASTM D 1557 maximum dry density within 3 percent of optimum moisture content. Satisfactory material removed below the depths indicated, without specific direction of the Owner's onsite Geotechnical Engineer, shall be replaced with satisfactory materials to the indicated excavation grade. Determination of elevations and measurements of approved over excavation of unsatisfactory material below grades indicated shall be done under the direction of the Owner's onsite Geotechnical Engineer.
- D. Pipe Trenches:
 - 1. Unless the construction of lines by tunneling, jacking, or boring is called for by the Drawings or specifically authorized by the Owner, make excavation for pipelines in open cut and true to the lines and grades shown on the Drawings. Cut the banks of trenches between vertical parallel planes equidistant from the pipe centerline. The horizontal distance between the vertical planes shall vary with the size of the pipe to be installed but shall not be more than the distance determined by the following formula: $4/3d + 15$ inches, where "d" represents the internal diameter of the pipe in inches. The banks of trenches from the ground surface down to a depth not closer than 1 foot above the top of the

pipe may be excavated to nonvertical and nonparallel planes, provided the excavation below that depth is made with vertical and parallel sides equidistant from the pipe centerline in accordance with the formula given above. Any cut made in excess of the formula $4/3d + 15$ inches shall be at the expense of the Contractor and may be cause for the Owner to require that stronger pipe and/or a higher class of bedding be used at no cost to the Owner.

2. Grade bottom of trenches to provide uniform support for each section of pipe after pipe bedding placement. Tamp if necessary to provide a firm pipe bed. Recesses shall be excavated to accommodate bells and joints so that pipe will be uniformly supported for the entire length. Rock, where encountered, shall be excavated to a depth of at least 6 inches below the bottom of the pipe.
3. Excavate bell holes for bell and spigot pipe at proper intervals so that the barrel of the pipe will rest for its entire length upon the bottom of the trench. Bell holes shall be large enough to permit proper jointing of the pipe. Do not excavate bell holes more than 2 joints ahead of pipe laying.
4. Provide minimum depths of "Bedding Material" as required by utility owner or City.
5. Do not excavate pipe trenches more than 200 feet ahead of the pipe laying and perform all work so as to cause the least possible inconvenience to the public. Construct temporary bridges or crossings when and where necessary to maintain vehicular or pedestrian traffic.
6. In all cases where materials are deposited along open trenches, place them so that in the event of rain no damage will result to the work and/or to adjacent property.

E. Hard Material and Rock

1. Any material that is encountered within the limits of the required excavation that cannot be removed except by drilling and/or blasting, including rock, boulders, masonry, hard pan, chert, shale, street and sidewalk pavements, and/or similar materials, shall be considered as unclassified excavation, and no separate payment will be made therefor.
2. Should rock be encountered in the excavation, remove it by mechanical means. Blasting will not be permitted.
3. Excavate rock over the horizontal limits of excavation and to a depth of not less than 6 inches below the bottom of pipe if rock extends to such depth. Then backfill the space below grade with crushed stone or other approved material, tamp to the proper grade, and make ready for construction.

F. Excavated Materials

1. Satisfactory excavated material required for fill or backfill shall be placed in the proper section of the permanent work required or shall be separately stockpiled if it cannot be readily placed. Satisfactory material in excess of that required for the permanent work and all unsatisfactory material shall be disposed of as specified in Paragraph "DISPOSITION OF SURPLUS MATERIAL."

3.4 Filling and Backfilling

- A. Fill and backfill to contours, elevations, and dimensions indicated. Compact each lift before placing overlaying lift.
- B. Backfill and Fill Material Placement for Utilities
 1. Begin backfilling after the line construction is completed and then inspected and approved by the Utility Owner. Place this backfill simultaneously on either side of the pipe in even layers that before compaction are no more than 6 inches deep. Thoroughly and completely tamp each layer into place before placing additional layers.
- C. At locations of improvements subject to damage by displacement, tamp and thoroughly compact the backfill in layers that, before compaction, are 6 inches deep. In other areas, the backfill for the upper portion of the trenches may be placed without tamping but shall be compacted to a density equivalent to that of adjacent earth material as determined by laboratory tests. Use special care to prevent the operation of backfilling equipment from causing any damage to the pipe.
- D. If earth material for backfill is, in the opinion of the Owner's on-site Geotechnical Engineer, too dry to allow thorough compaction, then add enough water so that the backfill can be properly compacted. Do not place earth material that the Owner's on-site Geotechnical Engineer considers too wet or otherwise unsuitable.
- E. Wherever trenches have been cut across or along existing pavement and driveways, including gravel or dirt drives, backfill trenches with crushed stone. Maintain until the permanent pavement is restored or until the project is accepted by the Owner.
- F. Conduct backfilling around manholes, inlets, outfalls, and/or structures in the same manner as specified above for pipelines except that even greater care is necessary to prevent damage to the utility structure.
- G. Do not use power operated tampers to tamp that portion of the backfill around the pipe within 1 foot above the pipe.
- H. Perform backfilling so as not to disturb or injure any pipe and/or structure against which the backfill is being placed. If any pipe or structure is damaged and/or displaced during backfilling, open up the backfill and make whatever repairs are necessary, whenever directed to do so by the Utility Owner.

- I. Backfilling and clean-up operations shall closely follow pipe laying; failure to comply with this provision will result in the Utility Owner requiring that the Contractor's other activities be suspended until backfilling and clean-up operations catch up with pipe laying.

3.5 Borrow

- A. Whenever the backfill of excavated areas or the placement of embankments requires more material than is available from authorized excavations, or whenever the backfill material from such excavations is unsuitable, then obtain additional material from other sources. This may require the opening of borrow pits at points accessible to the work. In such cases, make suitable arrangements with the property owner and pay all incidental costs, including any royalties, for the use of the borrowed material. Before a borrow pit is opened, the quality and suitability of its material shall be approved by the Owner's on-site Geotechnical Engineer.

3.6 Finish Operations

- A. Grading: Finish grades as indicated within one-tenth of one foot. Grade areas to drain water away from structures. Maintain areas free of trash and debris. For existing grades that will remain, but which were disturbed by Contractor's operations, grade as directed.
- B. Protection of Surfaces: Protect newly backfilled, graded, and topsoiled areas from traffic, erosion, and settlements that may occur. Repair or reestablish damaged grades, elevations, or slopes.

3.7 Disposition of Surplus Material

- A. Whenever practicable, all materials removed by excavation that are suitable for backfilling pipe trenches or for other purposes shown on the Drawings or directed by the Owner's onsite Geotechnical Engineer or Utility Company shall be used for these purposes. Any materials not so used shall be considered waste materials and disposed of by the Contractor as specified below.
- B. Once any part of the work is completed, properly dispose of all surplus or unused materials (including waste materials) left within the construction limits of that work. The Contractor shall dispose of these surplus and waste materials off-site in an appropriate manner in conformity with pertinent codes and ordinances. Leave the surface of the work in a neat and workmanlike condition, as described below.
- C. The disposal of waste materials shall be considered an integral part of the excavation work and one for which no separate payment shall be allowed.

3.8 Field Quality Control

- A. Sampling: Take the number and size of samples required to perform the following tests.

- B. Testing: Perform one of each of the following tests for each material used. Provide additional tests for each source change.
1. Bedding Material and Fill and Backfill Material Testing: Test fill and backfill material in accordance with ASTM C136 for conformance to ASTM D2487 gradation limits; ASTM D1140 for material finer than the No. 200 sieve; ASTM D4318 for liquid limit and for plastic limit; ASTM D698 or ASTM D1557 for moisture density relations, as applicable.
 2. Density Tests: Test density in accordance with ASTM D1556, or ASTM D6938. When ASTM D6938 density tests are used, verify density test results by performing an ASTM D1556 density test at a location already ASTM D6938 tested as specified herein. Perform an ASTM D1556 density test at the start of the job, and for every 10 ASTM D6938 density tests thereafter. Test each lift at randomly selected locations with one test per 200 linear feet in each lift.

END OF SECTION

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. Soil treatment.
 - 2. Wood treatment.
 - 3. Bait-station system.
 - 4. Metal mesh barrier system.

1.3 Action Submittals

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components, and profiles for termite control products.
 - 2. Include the EPA-Registered Label for termiticide products.

1.4 Informational Submittals

- A. Qualification Data: For qualified Installer.
- B. Product Certificates: For each type of termite control product.
- C. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:
 - 1. Date and time of application.
 - 2. Moisture content of soil before application.
 - 3. Termiticide brand name and manufacturer.
 - 4. Quantity of undiluted termiticide used.
 - 5. Dilutions, methods, volumes used, and rates of application.

6. Areas of application.
7. Water source for application.

D. Sample Warranties: For special warranties.

1.5 Quality Assurance

A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located and who is accredited by manufacturer.

1.6 Field Conditions

A. Soil Treatment:

1. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.
2. Related Work: Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.7 Warranty

A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work consisting of applied soil termiticide treatment will prevent infestation of subterranean termites, including Formosan termites (*Coptotermes formosanus*). If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: Five years from date of Substantial Completion.

Part 2 Products

2.1 Manufacturers

A. Source Limitations: Obtain termite control products from single source from single manufacturer.

2.2 Soil Treatment

A. Termiticide: EPA-Registered termiticide acceptable to authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation.

1. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

Part 3 Execution

3.1 Examination

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 Preparation

- A. General: Prepare work areas according to the requirements of authorities having jurisdiction and according to manufacturer's written instructions before beginning application and installation of termite control treatment(s). Remove extraneous sources of wood cellulose and other edible materials, such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials 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 footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
 1. Fit filling hose connected to water source at the site with a backflow preventer, according to requirements of authorities having jurisdiction.

3.3 Applying Soil Treatment

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Distribute treatment uniformly. Apply treatment at the product's EPA-Registered Label volume and rate for maximum specified concentration of termiticide to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction.
 1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
 2. Foundations: Soil adjacent to and along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing.

3. Masonry: Treat voids.
 4. Penetrations: At expansion joints, control joints, and areas where slabs and below-grade walls will be penetrated.
- B. Post warning signs in areas of application.
 - C. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

3.4 Protection

- A. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- B. Protect termiticide solution dispersed in treated soils and fills from being diluted by exposure to water spillage or weather until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

3.5 Maintenance Service

- A. Continuing Maintenance Proposal: Provide from termite-control-treatment Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.
 1. Include annual inspection for termite activity and effectiveness of termite treatment according to manufacturer's written instructions.

END OF SECTION

Part 1 General

1.1 Rights-Of-Way

- A. All work within State and County rights-of-way shall be in accordance with Florida Department of Transportation (FDOT) requirements.

1.2 Work Included

- A. Concrete curbs.
- B. Concrete gutters.
- C. Concrete combination curb and gutter.
- D. Concrete driveways.
- E. Concrete sidewalks shall be in accordance with landscape architect requirements instead of this section.

1.3 System Description

- A. General Requirements
 - 1. Provide plant, equipment, machines, and tools used in the work subject to approval and maintained in a satisfactory working condition at all times. The equipment shall have the capability of producing the required product, meeting grade controls, thickness control and smoothness requirements as specified.
 - 2. Use of the equipment shall be discontinued if it produces unsatisfactory results.
- B. Slip Form Equipment: Slip form paver or curb forming machine, will be approved based on trial use on the job and shall be self-propelled, automatically controlled, crawler mounted, and capable of spreading, consolidating, and shaping the plastic concrete to the desired cross section in one pass.

1.4 Submittals

- A. Submit the following in accordance with County's submittal requirements.
- B. Submit manufacturer/supplier certifications for aggregate and cement. Provide the project identification name and number, date of report, name of Contractor, name of concrete testing service, source of concrete aggregates, materials manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, and test results.

- C. Submit mix design in accordance with ACI requirements. Provide for each mix design, the project name, county, general contractor, concrete strength, and it's intended use.
- D. Submit 2 copies of laboratory test reports with standard deviation analysis or trial batch data. All concrete materials shall be listed.

1.5 Environmental Requirements

A. Placing During Cold Weather

1. Do not place concrete when the air temperature reaches 40 degrees F and is falling or is already below that point.
2. Placement may begin when the air temperature reaches 35 degrees F and is rising, or is already above 40 degrees F. Make provisions to protect the concrete from freezing during the specified curing period.
3. If necessary to place concrete when the temperature of the air, aggregates, or water is below 35 degrees F, placement and protection shall be approved in writing. Approval will be contingent upon full conformance with the following provisions.
4. The underlying material shall be prepared and protected so that it is entirely free of frost when the concrete is deposited.
5. Mixing water and aggregates shall be heated as necessary to result in the temperature of the in-place concrete being between 50- and 85-degrees F. Methods and equipment for heating shall be approved.
6. The aggregates shall be free of ice, snow, and frozen lumps before entering the mixer.
7. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period.

B. Placing During Warm Weather

1. The temperature of the concrete as placed shall not exceed 85 degrees F except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. The placing temperature shall not exceed 95 degrees F at any time.

Part 2 Products

2.1 Concrete

- A. Provide concrete conforming to the applicable requirements of Section 03 30 00 CAST-IN-PLACE CONCRETE except as otherwise specified. Concrete shall have a minimum compressive strength of 4000 psi at 28 days. Maximum size of aggregate shall be one inch. Submit copies of certified delivery tickets for all concrete used in the construction.
- B. Air Content
 - 1. Mixtures shall have air content by volume of concrete of 5 to 7 percent, based on measurements made immediately after discharge from the mixer.
- C. Slump
 - 1. The concrete slump shall be 2 inches plus or minus 1 inch where determined in accordance with ASTM C143.

2.2 Concrete Curing Materials

- A. Impervious Sheet Materials: Impervious sheet materials shall conform to ASTM C171, type optional, except that polyethylene film, if used, shall be white opaque.
- B. Burlap: Burlap shall conform to AASHTO M 182.
- C. White Pigmented Membrane-Forming Curing Compound: White pigmented membrane-forming curing compound shall conform to ASTM C309, Type 2.

2.3 Concrete Protection Materials

- A. Concrete protection materials shall be a linseed oil mixture of equal parts, by volume, of linseed oil and either mineral spirits, naphtha, or turpentine. At the option of the Contractor, commercially prepared linseed oil mixtures, formulated specifically for application to concrete to provide protection against the action of deicing chemicals may be used, except that emulsified mixtures are not acceptable.

2.4 Joint Filler Strips

- A. Contraction Joint Filler for Curb and Gutter: Contraction joint filler for curb and gutter shall consist of hard-pressed fiberboard.
- B. Expansion Joint Filler, Premolded
 - 1. Expansion joint filler, premolded, shall conform to ASTM D1751 or ASTM D1752, 1/2 inch thick, unless otherwise indicated.

2.5 Finish Materials

- A. Use commercial rock salt manufactured for use in water softeners, with particles from 1/8" to 3/8" in diameter.

2.6 Joint Sealants

- A. Joint sealant, cold-applied shall conform to ASTM C920 or ASTM D5893.

2.7 Form Work

- A. Design and construct form work to ensure that the finished concrete will conform accurately to the indicated dimensions, lines, and elevations, and within the tolerances specified.
- B. Forms shall be of wood or steel, straight, of sufficient strength to resist springing during depositing and consolidating concrete.
 - 1. Wood forms shall be surfaced plank, 2 inches nominal thickness, straight and free from warp, twist, loose knots, splits, or other defects.
 - a. Wood forms shall have a nominal length of 10 feet.
 - b. Radius bends may be formed with 3/4-inch boards, laminated to the required thickness.
 - 2. Steel forms shall be channel-formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points.
 - a. Ends of steel forms shall be interlocking and self-aligning.
 - b. Steel forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers.
 - c. Steel forms shall have a nominal length of 10 feet with a minimum of 3 welded stake pockets per form. Stake pins shall be solid steel rods with chamfered heads and pointed tips designed for use with steel forms.
- C. Sidewalk Forms: Sidewalk forms shall be of a height equal to the full depth of the finished sidewalk.
- D. Curb and Gutter Forms: Curb and gutter outside forms shall have a height equal to the full depth of the curb or gutter. The inside form of curb shall have batter as indicated and shall be securely fastened to and supported by the outside form.
 - 1. Rigid forms shall be provided for curb returns, except that benders or thin plank forms may be used for curb or curb returns with a radius of 10 feet or more, where grade changes occur in the return, or where the central angle is such that a rigid form with a central angle of 90 degrees cannot be used.

2. Back forms for curb returns may be made of 1-1/2 inch benders, for the full height of the curb, cleated together.
3. In lieu of inside forms for curbs, a curb "mule" may be used for forming and finishing this surface, provided the results are approved.

Part 3 Execution

3.1 Subgrade Preparation

- A. The subgrade shall be constructed to the specified grade and cross section prior to concrete placement.
- B. Sidewalk Subgrade: The subgrade shall be tested for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.
- C. Curb and Gutter Subgrade: The subgrade shall be tested for grade and cross section by means of a template extending the full width of the curb and gutter. The subgrade shall be of materials equal in bearing quality to the subgrade under the adjacent pavement.
- D. Maintenance of Subgrade: The subgrade shall be maintained in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. The subgrade shall be in a moist condition when concrete is placed. The subgrade shall be prepared and protected to produce a subgrade free from frost when the concrete is deposited.

3.2 Form Setting

- A. Set forms to the indicated alignment, grade, and dimensions.
- B. Hold forms rigidly in place by a minimum of 3 stakes per form placed at intervals not to exceed 4 feet.
 1. Corners, deep sections, and radius bends shall have additional stakes and braces, as required.
 2. Clamps, spreaders, and braces shall be used where required to ensure rigidity in the forms.
- C. Forms shall be removed without injuring the concrete.
 1. Bars or heavy tools shall not be used against the concrete in removing the forms.
- D. Any concrete found defective after form removal shall be promptly and satisfactorily repaired.

- E. Forms shall be cleaned and coated with form oil each time before concrete is placed.
 - 1. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory.
- F. Sidewalks
 - 1. Set forms for sidewalks with the upper edge true to line and grade with an allowable tolerance of 1/4 inch in any 10-foot-long section.
 - 2. After forms are set, grade and alignment shall be checked with a 10-foot straightedge.
 - 3. Forms shall have a transverse slope as indicated with the low side adjacent to the roadway. Side forms shall not be removed for 12 hours after finishing has been completed.
- G. Curbs and Gutters
 - 1. The forms of the front of the curb shall be removed not less than 2 hours nor more than 6 hours after the concrete has been placed.
 - 2. Forms back of curb shall remain in place until the face and top of the curb have been finished, as specified for concrete finishing.
 - 3. Gutter forms shall not be removed while the concrete is sufficiently plastic to slump in any direction.

3.3 Sidewalk Concrete Placement and Finishing

- A. Formed Sidewalks
 - 1. Place concrete in the forms in one layer. When consolidated and finished, the sidewalks shall be of the thickness indicated.
 - 2. After concrete has been placed in the forms, a strike-off guided by side forms shall be used to bring the surface to proper section to be compacted.
 - 3. The concrete shall be consolidated by tamping and spading or with an approved vibrator, and the surface shall be finished to grade with a strike off.
- B. Concrete Finishing
 - 1. After straightedging, when most of the water sheen has disappeared, and just before the concrete hardens, finish the surface with a wood or magnesium float or darby to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. A scored surface shall be produced by brooming with a fiber-bristle brush in a direction transverse to that of the traffic, followed by edging.

2. Rock Salt Finish: Where specified on plans, contractor shall apply a medium rock salt finish. Float and smooth the finish of the concrete prior to application of the salt. Uniformly apply salt crystals at a rate of 5 pounds per 100 square feet. After application, press the salt crystals into the surface approximately $\frac{1}{2}$ of their diameter with a roller or tamper. After a minimum of 12 hours setting time, wash away salt and salt residue prior to concrete being sealed.
3. Edge and Joint Finishing:
 - a. All slab edges, including those at formed joints, shall be finished with an edger having a radius of $\frac{1}{8}$ inch.
 - b. Transverse joint shall be edged before brooming, and the brooming shall eliminate the flat surface left by the surface face of the edger.
 - c. Corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing shall be cleaned and filled solidly with a properly proportioned mortar mixture and then finished.
- C. Surface and Thickness Tolerances: Finished surfaces shall not vary more than $\frac{5}{16}$ inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to $\frac{1}{4}$ inch.

3.4 Curb and Gutter Concrete Placement and Finishing

- A. Formed Curb and Gutter: Concrete shall be placed to the section required in a single lift. Consolidation shall be achieved by using approved mechanical vibrators. Curve shaped gutters shall be finished with a standard curb "mule".
- B. Curb and Gutter Finishing: Approved slipformed curb and gutter machines may be used in lieu of hand placement.
- C. Concrete Finishing
 1. Exposed surfaces shall be floated and finished with a smooth wood float until true to grade and section and uniform in texture. Floated surfaces shall then be brushed with a fine-hair brush with longitudinal strokes.
 2. The edges of the gutter and top of the curb shall be rounded with an edging tool to a radius of $\frac{1}{2}$ inch.
 3. Immediately after removing the front curb form, the face of the curb shall be rubbed with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. The front curb surface, while still wet, shall be brushed in the same manner as the gutter and curb top.
 4. The top surface of gutter and entrance shall be finished to grade with a wood float.
 5. Joint Finishing: Curb edges at formed joints shall be finished as indicated.

- D. Surface and Thickness Tolerances: Finished surfaces shall not vary more than 1/4 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

3.5 Sidewalk Joints

- A. Sidewalk joints shall be constructed to divide the surface into rectangular areas.
1. Transverse contraction joints shall be spaced at a distance equal to the sidewalk width or 5 feet on centers, whichever is less, and shall be continuous across the slab.
 2. Longitudinal contraction joints shall be constructed along the centerline of all sidewalks 10 feet or more in width.
 3. Transverse expansion joints shall be installed at sidewalk returns and opposite expansion joints in adjoining curbs.
 4. Where the sidewalk is not in contact with the curb, transverse expansion joints shall be installed as indicated.
- B. Expansion joints shall be formed about structures and features which project through or into the sidewalk pavement, using joint filler of the type, thickness, and width indicated.
1. Expansion joints are not required between sidewalks and curb that abut the sidewalk longitudinally.
- C. Sidewalk Contraction Joints: The contraction joints shall be formed in the fresh concrete by cutting a groove in the top portion of the slab to a depth of at least one-fourth of the sidewalk slab thickness, using a jointer to cut the groove, or by sawing a groove in the hardened concrete with a power-driven saw, unless otherwise approved.
1. Sawed joints shall be constructed by sawing a groove in the concrete with a 1/8-inch blade to the depth indicated.
 2. An ample supply of saw blades shall be available on the job before concrete placement is started, and at least one standby sawing unit in good working order shall be available at the jobsite at all times during the sawing operations.
- D. Sidewalk Expansion Joints
1. Expansion joints shall be formed with 1/2-inch joint filler strips. Joint filler in expansion joints surrounding structures and features within the sidewalk may consist of preformed filler material conforming to ASTM D1752 or building paper.
 2. Joint filler shall be held in place with steel pins or other devices to prevent warping of the filler during floating and finishing.

3. Immediately after finishing operations are completed, joint edges shall be rounded with an edging tool having a radius of 1/8 inch, and concrete over the joint filler shall be removed.
4. At the end of the curing period, expansion joints shall be cleaned and filled with cold-applied joint sealant.
5. Joint sealant shall be gray or stone in color.
6. The joint opening shall be thoroughly cleaned before the sealing material is placed.
7. Sealing material shall not be spilled on exposed surfaces of the concrete.
8. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 50 degrees F at the time of application of joint sealing material.
9. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.

3.6 Curb and Gutter Joints

- A. Curb and gutter joints shall be constructed at right angles to the line of curb and gutter.
- B. Contraction Joints
 1. Contraction joints shall be constructed directly opposite contraction joints in abutting portland cement concrete pavements and spaced so that monolithic sections between curb returns will not be less than 5 feet nor greater than 15 feet in length.
 2. Contraction joints (except for slip forming) shall be constructed by means of 1/8-inch-thick separators and of a section conforming to the cross section of the curb and gutter. Separators shall be removed as soon as practicable after concrete has set sufficiently to preserve the width and shape of the joint and prior to finishing.
 3. When slip forming is used, the contraction joints shall be cut in the top portion of the gutter/curb hardened concrete in a continuous cut across the curb and gutter, using a power-driven saw. The depth of cut shall be at least one-fourth of the gutter/curb depth and 1/8 inch in width.
- C. Expansion Joints
 1. Expansion joints shall be formed by means of preformed expansion joint filler material cut and shaped to the cross section of curb and gutter. Expansion joints shall be provided in curb and gutter directly opposite expansion joints of

abutting portland cement concrete pavement, and shall be of the same type and thickness as joints in the pavement.

2. Where curb and gutter do not abut portland cement concrete pavement, expansion joints at least 1/2 inch in width shall be provided at intervals not less than 30 feet nor greater than 120 feet.
3. Expansion joints shall be provided in nonreinforced concrete gutter at locations indicated.
4. Expansion joints shall be sealed immediately following curing of the concrete or as soon thereafter as weather conditions permit.
5. Expansion joints and the top 1-inch depth of curb and gutter contraction-joints shall be sealed with joint sealant.
6. The joint opening shall be thoroughly cleaned before the sealing material is placed.
7. Sealing material shall not be spilled on exposed surfaces of the concrete.
8. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 50 degrees F at the time of application of joint sealing material.
9. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.

3.7 Curing and Protection

A. General Requirements

1. Protect concrete against loss of moisture and rapid temperature changes for at least 7 days from the beginning of the curing operation.
2. Protect unhardened concrete from rain and flowing water.
3. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready for use before actual concrete placement begins.
4. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period.

B. Mat Method

1. The entire exposed surface shall be covered with 2 or more layers of burlap.
2. Mats shall overlap each other at least 12 inches.

3. The mat shall be thoroughly wetted with water prior to placing on concrete surface and shall be kept continuously in a saturated condition and in intimate contact with concrete for not less than 72 hours.

C. Impervious Sheeting Method

1. The entire exposed surface shall be wetted with a fine spray of water and then covered with impervious sheeting material.
2. Sheets shall be laid directly on the concrete surface with the light-colored side up and overlapped 12 inches when a continuous sheet is not used.
3. The curing medium shall not be less than 18-inches wider than the concrete surface to be cured, and shall be securely weighted down by heavy wood planks, or a bank of moist earth placed along edges and laps in the sheets.
4. Sheets shall be satisfactorily repaired or replaced if torn or otherwise damaged during curing.
5. The curing medium shall remain on the concrete surface to be cured for not less than 72 hours.

D. Membrane Curing Method

1. A uniform coating of white-pigmented membrane-curing compound shall be applied to the entire exposed surface of the concrete as soon after finishing as the free water has disappeared from the finished surface. Formed surfaces shall be coated immediately after the forms are removed and in no case longer than 1 hour after the removal of forms.
2. Concrete shall not be allowed to dry before the application of the membrane. If any drying has occurred, the surface of the concrete shall be moistened with a fine spray of water and the curing compound applied as soon as the free water disappears.
3. Curing compound shall be applied in two coats by hand-operated pressure sprayers at a coverage rate of approximately 200 square feet/gallon for the total of both coats.
4. The second coat shall be applied in a direction approximately at right angles to the direction of application of the first coat.
5. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. If pinholes, abrasion, or other discontinuities exist, an additional coat shall be applied to the affected areas within 30 minutes.
6. Concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied shall be resprayed by the method and at the coverage specified above.

7. Areas where the curing compound is damaged by subsequent construction operations within the curing period shall be resprayed.
8. Necessary precautions shall be taken to ensure that the concrete is properly cured at sawed joints, and that no curing compound enters the joints.
9. The top of the joint opening and the joint groove at exposed edges shall be tightly sealed before the concrete in the region of the joint is resprayed with curing compound. The method used for sealing the joint groove shall prevent loss of moisture from the joint during the entire specified curing period.
10. Approved standby facilities for curing concrete pavement shall be provided at a location accessible to the jobsite for use in the event of mechanical failure of the spraying equipment or other conditions that might prevent correct application of the membrane-curing compound at the proper time.
11. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected during the entire curing period from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from any other possible damage to the continuity of the membrane.

3.8 Backfilling

- A. After curing, debris shall be removed and the area adjoining the concrete shall be backfilled, graded, and compacted to conform to the surrounding area in accordance with lines and grades indicated.

3.9 Protection

- A. Completed concrete shall be protected from damage until accepted.
- B. Repair damaged concrete and clean concrete discolored during construction. Concrete that is damaged shall be removed and reconstructed for the entire length between regularly scheduled joints. Refinishing the damaged portion will not be acceptable. Removed damaged portions shall be disposed of as directed.
- C. Protective Coating
 1. Protective coating, of linseed oil mixture, shall be applied to the exposed-to-view concrete surface after the curing period, if concrete will be exposed to de-icing chemicals within 6 weeks after placement.
 2. Concrete to receive a protective coating shall be moist cured.
 3. Application
 - a. Curing and backfilling operation shall be completed prior to applying two coats of protective coating.

- b. Concrete shall be surface dry and clean before each application.
 - c. Coverage shall be by spray application at not more than 50 square yards/gallon for first application and not more than 70 square yards/gallon for second application, except that the number of applications and coverage for each application for commercially prepared mixture shall be in accordance with the manufacturer's instructions.
 - d. Coated surfaces shall be protected from vehicular and pedestrian traffic until dry.
4. Precautions
- a. Protective coating shall not be heated by direct application of flame or electrical heaters and shall be protected from exposure to open flame, sparks, and fire adjacent to open containers or applicators.
 - b. Material shall not be applied at ambient or material temperatures lower than 50 degrees F.

3.10 Field Quality Control

- A. Submit copies of all test reports within 24 hours of completion of the test.
- B. General Requirements
 - 1. Perform the inspection and tests described and meet the specified requirements for inspection details and frequency of testing.
 - 2. Based upon the results of these inspections and tests, take the action and submit reports as required below, and any additional tests to ensure that the requirements of these specifications are met.
- C. Concrete Testing
 - 1. Strength Testing: Provide molded concrete specimens for strength tests. Samples of concrete placed each day shall be taken not less than once a day nor less than once for every 250 cubic yards of concrete. The samples for strength tests shall be taken in accordance with ASTM C172. Cylinders for acceptance shall be molded in conformance with ASTM C31 by an approved testing laboratory. Each strength test result shall be the average of 2 test cylinders from the same concrete sample tested at 28 days, unless otherwise specified or approved. Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength, and no individual strength test result falls below the specified strength by more than 500 psi.

2. **Air Content:** Determine air content in accordance with ASTM C173 or ASTM C231. ASTM C231 shall be used with concretes and mortars made with relatively dense natural aggregates. Two tests for air content shall be made on randomly selected batches of each class of concrete placed during each shift. Additional tests shall be made when excessive variation in concrete workability is reported by the placing foreman or the Owner's inspector. If results are out of tolerance, the placing foreman shall be notified, and he shall take appropriate action to have the air content corrected at the plant. Additional tests for air content will be performed on each truckload of material until such time as the air content is within the tolerance specified.
3. **Slump Test:** Two slump tests shall be made on randomly selected batches of each class of concrete for every 250 cubic yards, or fraction thereof, of concrete placed during each shift. Additional tests shall be performed when excessive variation in the workability of the concrete is noted or when excessive crumbling or slumping is noted along the edges of slip-formed concrete.
4. **Thickness Evaluation:** The anticipated thickness of the concrete shall be determined prior to placement by passing a template through the formed section or by measuring the depth of opening of the extrusion template of the curb forming machine. If a slip form paver is used for sidewalk placement, the subgrade shall be true to grade prior to concrete placement and the thickness will be determined by measuring each edge of the completed slab.
5. **Surface Evaluation:** The finished surface of each category of the completed work shall be uniform in color and free of blemishes and form or tool marks.

3.11 Surface Deficiencies and Corrections

- A. **Thickness Deficiency:** When measurements indicate that the completed concrete section is deficient in thickness by more than 1/4 inch the deficient section will be removed, between regularly scheduled joints, and replaced.
- B. **High Areas:** In areas not meeting surface smoothness and plan grade requirements, high areas shall be reduced either by rubbing the freshly finished concrete with carborundum brick and water when the concrete is less than 36 hours old or by grinding the hardened concrete with an approved surface grinding machine after the concrete is 36 hours old or more. The area corrected by grinding the surface of the hardened concrete shall not exceed 5 percent of the area of any integral slab, and the depth of grinding shall not exceed 1/4 inch. Areas requiring grade or surface smoothness corrections in excess of the limits specified above shall be removed and replaced.
- C. **Appearance:** Exposed surfaces of the finished work will be inspected by the Owner and any deficiencies in appearance will be identified. Areas which exhibit excessive cracking, discoloration, form marks, or tool marks or which are otherwise inconsistent with the overall appearances of the work shall be removed and replaced.

3.12 Detectable Warning System

- A. Install Detectable Warning Systems required by contract plans per ICC A117.1, Section 705, and by manufacturers' installation instructions.

END OF SECTION

Part 1 General

1.1 Work Included

- A. Furnish and install concrete wheel bumpers (wheel stops) as indicated on the drawings and specified.

1.2 Submittals

- A. Submit in accordance with County's submittal requirements.
- B. Product Data: Submit information describing the materials used in the manufacture of the wheel bumpers.

Part 2 Products

2.1 Materials

- A. Concrete shall conform to the following:
 - 1. Minimum compressive strength: 4,000 pounds per square inch (psi) minimum at 28 days.
 - 2. Air content: 5 to 8 percent.
 - 3. Size of bumpers shall be as indicated on the drawings.
- B. Reinforcing bars shall be deformed billet steel conforming to ASTM A615, Grade 60.
- C. Anchor stakes for driving into the ground shall be No. 4 reinforcing bars or steel pipe conforming to ASTM A53.
- D. Adhesive for Securing of Concrete Wheel Bumpers: An epoxy two-component type, long curing, manufactured by Edeco, Furance, Andrew Brown, Adhesive Engineering Company, or equal.

Part 3 Execution

3.1 Installation on Asphalt Pavements

- A. Secure bumpers in place with steel stakes, two per bumper, driven to at least 1/4-inch below top surface of the bumper, through the pavement and not less than 12 inches into the subgrade.

3.2 Installation On Portland Cement Concrete Pavements

- A. Secure bumpers in place with 2-component epoxy adhesive. Surfaces to receive adhesive to be free of laitance, dirt, loose particles, or other foreign matter and shall be completely cured and dry.
- B. Slightly roughen the smooth surfaces as recommended by the adhesive manufacturer to provide for proper bond. Properly cure the adhesive after placing of bumper unit.

END OF SECTION

Part 1 General

1.1 Summary

- A. Section includes painted striping and markings applied to existing asphalt pavement.

1.2 Design Requirements

- A. All striping and pavement markings shall adhere to Florida Department of Transportation (FDOT) Standard Specifications, Sections 710, latest edition.

1.3 Submittals

- A. Product Data: For each type of product.
 - 1. Include technical data, manufacturer, and tested physical and performance properties.

Part 2 Products

2.1 Traffic Paint

- A. Conform to Section 710-2, Florida Department of Transportation (FDOT) Standard Specifications, latest edition.

2.2 Equipment – Painting Machine

- A. Conform to Section 710-3, Florida Department of Transportation (FDOT) Standard Specifications, latest edition.

Part 3 Execution

3.1 Examination

- A. Conform to Section 710-4, Florida Department of Transportation (FDOT) Standard Specifications, latest edition.

3.2 Pavement Marking

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Owner Representative.

3.3 Protecting and Cleaning

- A. Protect pavement markings from damage and wear during remainder of construction period. Remove and replace any portion of the pavement markings damaged by passing or construction traffic or from any other cause at no additional cost to the Owner.

END OF SECTION

Part 1 General

1.1 Summary

A. Section Includes:

1. Chain-link fences.
2. Swing gates.

B. Related Requirements:

1. Section 03 30 00 "Cast-in-Place Concrete" for cast-in-place concrete.

1.2 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 the following:
 - a. Fence and gate posts, rails, and fittings.
 - b. Chain-link fabric, reinforcements, and attachments.
 - c. Gates and hardware.

B. Shop Drawings: For each type of fence and gate assembly.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include accessories, hardware, gate operation, and operational clearances.

C. Samples for Initial Selection: For each type of factory-applied finish.

D. Samples for Verification: For each type of component with factory-applied finish, prepared on Samples of size indicated below:

1. Polymer-Coated Components: In 6-inch lengths for components and on full-sized units for accessories.

E. Delegated-Design Submittal: For structural performance of chain-link fence and gate frameworks, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 Field Conditions

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.
- B. Coordination: Coordinate fence locations with proposed net post locations, as well as ballfield and other site hardscape improvements.

1.4 Warranty

- A. Special Warranty: Manufacturer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to comply with performance requirements.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: Five years from date of Substantial Completion.

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 chain-link fence and gate frameworks.
- B. Structural Performance: Chain-link fence and gate frameworks shall withstand the design wind loads and stresses for fence height(s) and under exposure conditions indicated according to ASCE/SEI 7.

2.2 Chain Link Fence Fabric

- A. PVC or polyolefin elastomer coating, 7 mil thickness, thermally fused to zinc-coated steel core wire: Per ASTM F668 Class 2b. Core wire tensile strength 75,000 psi.
- B. Size: Helically wound and woven to height as indicated on drawings with 2" diamond mesh, 9 gauge wire core (before coating) with a diameter of .148 inch, 6 gauge finish (after coating) with a break load of 1290 lbf. Use 6 gauge (before coating) to be used at backstop per drawings. Color Black ASTM F 934
- C. Selvage of fabric knuckled at top and knuckled at bottom.

2.3 Steel Fence Framing

- A. Steel pipe - Type II: Cold formed and welded steel pipe complying with ASTM F 1043, Group IC, with minimum yield strength of 50,000 psi (344 MPa), sizes as indicated. Protective coating per ASTM F 1043, external coating Type B, zinc with organic overcoat, 0.9 oz/ft² minimum zinc coating with chromate conversion coating and verifiable polymer film. Internal coating Type B, minimum 0.9 oz/ft² zinc or Type D, zinc pigmented, 81% nominal coating, minimum 3 mils thick.
- B. PVC-Coated finish: In accordance with ASTM F1043, apply supplemental color coating of 10 to 15 mils of thermally fused PVC. Color to match fabric.

Height of Fence Fabric	End Post (Round)	Line Post (Round)	Mid-Rail & Brace
4 ft. to 8 ft.	3.5" O.D.	2.5" O.D.	1-5/8" O.D.
10 ft. & over	4" O.D.	3" O.D.	1-5/8" O.D.
Backstop fences	6" O.D.	4" O.D.	1-5/8" O.D.

2.4 Chain Link Swing Gates

- A. Gate frames: Fabricate chain link swing gates in accordance with ASTM F 900 using galvanized steel tubular members. Fusion or stainless steel welded connections forming rigid one-piece unit. Vinyl coated frames thermally fused with 10 to 15 mils of PVC per ASTM 1043.
- B. For gates over 8' high or 15' wide, provide minimum 1-1/2" square additional horizontal and vertical interior members to ensure proper strength. See drawings for gate sizes.
- C. Chain link fence fabric: PVC thermally fused to metallic coated steel wire, ASTM F 668, Class 2b, in black Color, mesh, and gauge to match fence. Install fabric with hook bolts and tension bars at all 4 sides. Attach to gate frame at not more than 15" on center.
- D. Hardware materials: Hot dipped galvanized steel or malleable iron shapes to suit gate size. Field coat moveable parts (e.g. hinges, latch, keeper, and drop bar) with PVC touch up paint, provided by manufacturer, to match adjacent finishes.
- E. Hinges: Heavy duty structurally capable of supporting gate leaf and allow opening and closing without binding. Non-lift-off type hinge design shall permit gate to swing 180 degrees or as indicated on the plans.
- F. Latch: Forked type capable of retaining gate in closed position and have provision for padlock. Latch shall permit operation from either side of gate.
- G. Keeper: Provide keeper for each gate leaf. Gate keeper shall consist of mechanical device for securing free end of gate when in full open position.

- H. Double gates: Provide drop rod to hold inactive leaf. Provide gate stop pipe to engage center drop rod. Provide locking device and padlock eyes as an integral part of latch, requiring one padlock for locking both gate leaves.
- I. Gate posts (PVC coated): Steel pipe, ASTM F 1083, standard weight schedule 40; minimum yield strength of 25,000 psi

Gate leaf single width	Post Size (Round)	Weight
4 ft or less	2.875 in	5.79 lb/ft
Over 4 ft to 8 ft	3.50 in	9.11 lb/ft

2.5 Accessories

- A. Chain link fence accessories: ASTM F 626 Provide items required to complete fence system. Galvanize each ferrous metal item and finish to match framing.
- B. Post caps: Formed steel, cast malleable iron, or aluminum alloy weather tight closure cap for tubular posts. Provide one cap for each post. Cap to have provision for barbed wire when necessary. (Where top rail is used, provide tops to permit passage of top rail.)
- C. Top rail and brace rail ends: Pressed steel per ASTM F626, for connection of rail and brace to terminal posts.
- D. Top rail sleeves: 7" expansion sleeve with spring, allowing for expansion and contraction of top rail.
- E. Wire ties: 9 gauge galvanized steel wire for attachment of fabric to line posts. Double wrap 13 gauge for rails and braces. Hog ring ties of 12-1/2 gauge for attachment of fabric to tension wire. No aluminum ties will be permitted.
- F. Brace and tension (stretcher bar) bands: Pressed steel.
- G. Tension (stretcher) bars: One piece lengths equal to 2 inches less than full height of fabric with a minimum cross-section of 3/16" x 3/4" or equivalent fiber glass rod. Provide tension (stretcher) bars where chain link fabric meets terminal posts.
- H. Tension wire: Thermally fused vinyl (Permafused) applied to metallic coated steel wire, 7 gauge, 0.177" diameter core wire with tensile strength of 75,000 psi.
- I. Truss rods & tightener: Steel rods with minimum diameter of 5/16". Capable of withstanding a tension of minimum 2,000 lbs.
- J. Nuts and bolts are galvanized but not vinyl coated. Paint with PVC touch up paint to match fabric.

2.6 Setting Materials

- A. Concrete: Minimum 28 day compressive strength of 3,000 psi.

Part 3 Execution

3.1 Examination

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
 - 1. Do not begin installation before final grading is completed unless otherwise permitted by Owners Rep..
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Preparation

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 Chain Link Fence Framing Installation

- A. Install chain link fence in accordance with ASTM F 567.
- B. Locate terminal post at each fence termination and change in horizontal or vertical direction of 30° or more.
- C. Space line posts uniformly at 10' on center.
- D. Concrete set terminal, line and gate posts: Drill holes in firm, undisturbed or compacted soil. Holes shall have diameter four times the diameter of the post, and depths approximately 6" deeper than post bottom. Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads. Set post bottom 36" below surface when in firm, undisturbed soil. Place concrete around posts in a continuous pour. Trowel finish around post and slope to direct water away from posts.
- E. Check each post for vertical and top alignment and maintain in position during placement and finishing operations.
- F. Bracing: Install horizontal pipe brace at mid-height for fences 6' and over, and on each side of terminal posts. Firmly attach with fittings. Install diagonal truss rods at these points. Adjust truss rod, ensuring posts remain plumb.
- G. Tension wire: Provide tension wire at bottom of fabric. Install tension wire before stretching fabric and attach to each post with ties. Secure tension wire to fabric with 12-1/2 gauge hog rings 24" oc.
- H. Top rail: Install lengths, 21'. Connect joints with sleeves for rigid connections for expansion/contraction.

- I. Bottom Rail: Install as indicated on plans.
- J. Mid-Rail: Provide mid-rails at the center height of the fence fabric unless otherwise detailed or noted on plans. Install in one piece between posts and flush with post on fabric side, using special offset fittings where necessary.

3.4 Chain Link Fabric Installation

- A. Fabric: Install fabric on security side and attach so that fabric remains in tension after pulling force is released. Leave approximately 2" between finish grade and bottom selvage. Attach fabric with steel wire ties to line posts at 15" on center and to rails, braces, and tension wire at 24" on center.
- B. Tension (stretcher) bars: Pull fabric taut; thread tension bar through fabric and attach to terminal posts with bands or clips spaced maximum of 15" on center.

3.5 Chain Link Swing Gate Post Installation

- A. Install gate posts in accordance with manufacturer's instructions.
- B. Concrete set gate posts: Drill holes in firm, undisturbed or compacted soil. Holes shall have diameter four times the diameter of the post, and depths approximately 6" deeper than post bottom. Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads. Set post bottom 36" below surface when in firm, undisturbed soil. Place concrete around posts in a continuous pour. Trowel finish around post and slope to direct water away from posts.
 - 1. Gate posts and hardware: Set keeper, stops, sleeves into concrete. Check each post for vertical and top alignment and maintain in position during placement and finishing operations.

3.6 Gate Installation

- A. Install gates plumb, level, and secure for full opening without interference.
- B. Attach hardware by means which will prevent unauthorized removal.
- C. Adjust hardware for smooth operation.
- D. Touch up hardware.

3.7 Accessories

- A. Tie wires: Bend ends of wire to minimize hazard to persons and clothing.
- B. Fasteners: Install nuts on side of fence opposite fabric side for added security.

3.8 Cleaning

- A. Clean up debris and unused material and remove from the site.

END OF SECTION

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 piping, valves, sprinklers, controls, and wiring for automatic control irrigation systems.
- B. Extent of the underground irrigation system is shown in the plans, schedules, and notes.
- C. Provide all labor. Materials and equipment required or inferred from the Drawing and Specifications to complete the Work of this Section.
- D. Provide a complete and operable system for the irrigation of all landscapes areas on the project site, unless indicated otherwise. The Drawings and specifications are intended to include all items obviously necessary and requisite for the proper irrigation of the project.
- E. The contractor shall be responsible for adjusting head locations, nozzle type and size, and any other system components so that the irrigation system layout is coordinated with actual field conditions. Such adjustments shall be made at no cost to the Owner except, when authorized in writing, such adjustments which will be compensated for at an agreed upon cost.

1.3 Definitions

- A. Lateral Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.
- B. Drain Piping: Downstream from circuit-piping drain valves. Piping is not under pressure.
- C. Mainline Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.
- D. The following are industry abbreviations for plastic materials:
 - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
 - 2. FRP: Fiberglass-reinforced plastic.
 - 3. PA: Polyamide (nylon) plastic.

4. PE: Polyethylene plastic.
5. PP: Polypropylene plastic.
6. PTFE: Polytetrafluoroethylene plastic.
7. PVC: Polyvinyl chloride plastic.
8. TFE: Tetrafluoroethylene plastic.
9. HDPE High Density Polyethylene plastic.

1.4 Performance Requirements

- A. Head-to-head coverage irrigation system for lawns and exterior plants as shown or indicated on associated plans.
- B. Drawings are diagrammatic and generally indicate the Work to be installed. The Drawing do not indicate all off-set fittings that may be necessary. The Contractor shall furnish such items as may be required to complete the work.
- C. Location of Sprinklers and Specialties: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards. Maintain a minimum of head-to-head coverage and dripline row spacing for turf and planting areas unless otherwise indicated.
- D. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties, unless otherwise indicated:
 1. Irrigation Main Piping: 200 psi.
 2. Lateral Piping: 200 psi.

1.5 Submittals

- A. Approval: Obtain approval from Landscape Architect for all submittals prior to the beginning of Work, unless otherwise approved.
- B. Product Data: Individual copies for product data shall be submitted Include pressure ratings, rated capacities, and settings of selected models for the following:
 1. Contractor Qualifications as per Section 1.06.A.
 2. Sprinklers and nozzles.
 3. Electrical Control Valves.
 4. Drip Control Valves.
 5. Quick Coupler Valves.

6. Isolation Valves.
 7. Valve boxes.
 8. Drip Tubing and fittings.
 9. Drip Indicator.
 10. Controllers and associated communication equipment.
 11. Control cables. Include splice kits.
 12. Decoders.
 13. Grounding equipment.
 14. Rain Sensor
 15. PVC fittings.
 16. PVC Primer and Cement.
 17. Mainline, Lateral and Sleeve piping.
 18. Mainline, Lateral pipe fittings
- C. As-Built Drawings: Any changes in the layout and or arrangements of the proposed irrigation system, or any other differences between the proposed system and actual installed conditions are to be recorded by the Irrigation Contractor in the form of an "As-Built" Drawing. As-Built Drawing to be produced in an electronic format using AutoCAD. Provide the Owner and the Landscape Architect and AutoCAD & PDF file along with five (5) hard copies of the As-Built Drawings before Work under this Contract will be considered for Acceptance. All automatic and manual valves, hose bibs or quick couplers, wire splice, and pressurized mainline locations shall be show with actual field dimensions in feet and inches from tow permanent reference points so they may be located easily in the field. Submittals of approved As-Built Drawing will precede any Application for Final Payment by the Contractor.
- D. Operation and Maintenance Data: For irrigation systems, to include in emergency, operation, and maintenance manuals, including data for the following:
1. Automatic-control valves.
 2. Isolation valves.
 3. Sprinklers.
 4. Control systems.

- E. Test Reports: Field test results of the irrigation supply well to include flow rates, and recovery rates.
- F. Shop Drawings: Submit certified shop drawings showing complete information for fabrication and installation of pump station. Shop drawings shall include a complete electrical wiring diagram.

1.6 Quality Assurance

- A. Installer Qualifications: Installing contractor must be licensed in the state that the work is being conducted. In the absence of a license requirement the contractor must be an Irrigation Association Certified Contractor, in good standing. Engage a firm or firms specializing in irrigation system installation. Installer shall have successfully completed five projects similar in material, size, scope and complexity to that indicated for this Project that have resulted in construction with a record of successful in-service performance. Provide listing of the 5 similar project showing number of zones, water source, mainline sizes, control system and project contact phone number and e-mail address. Contractor to be an Irrigation Association CID. Contractor must have manufacturers 2-wire installation and programming training certificates.
- B. 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.
- C. Codes and Standards: Perform the work in compliance with applicable requirements of governing authorities having jurisdiction. County regulations supersede these specifications. Notify Landscape Architect in writing of all discrepancies immediately.
- D. Approval and Selection of Materials and Work: The selection of all materials and the execution of all operations required under the Drawings and Specifications is subject to the approval of the Owner and Landscape Architect. They have the right to reject any and all materials and any and all work which, in their opinion, does not meet the requirements of the Contract Documents at any state of the operations. Remove rejected Work and or materials from the project site and replace promptly.
- E. Do Not Make Substitutions: If the Contractor desires to make substitutions of materials, sufficient descriptive literature and material samples must be furnished to establish the material as an equal substitute. In addition, the Contractor must state his reasons for desiring substitute materials and any potential cost savings. Submit this request and information to the Landscape Architect.

1.7 Delivery, Storage, and Handling

- A. Deliver piping 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.

- B. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.8 Project Conditions

- A. The site irrigation system is comprised of 2 major components, sprinkler system and the control system.
- B. The irrigation system is designed to operate under the following conditions. A minimum of 60 psi water pressure, and at least a 250 gpm available water supply at the pump station discharge outlet.
- C. Insurance on irrigation materials or equipment stored or installed is the responsibility of the Contractor. Such insurance shall cover fire, theft and vandalism. Should the Contractor elect not to provide for such insurance, he will in no way hold the Owner responsible for any losses incurred by the aforementioned acts. The Contractor is responsible for all costs incurred in replacing damaged or stolen materials or equipment prior to Substantial Completion of the Work.
- D. Obtain all required permits and pay all required fees, at no additional cost to the Owner. Any penalties imposed due to the failure to obtain permits or pay fees are the responsibility of the Contractor.
- E. Provide and maintain all passageways, guard fences, warning lights and other protective devices required by the local authorities.
- F. Existing grades: Existing grades will be within .2 feet of grades shown on the Civil Engineering Drawings at the time of work. Determine conditions of existing grades prior to beginning the Work. When irregular or incomplete grading conditions are encountered, notify the Owner in writing before beginning the Work. Determine location of existing drainage patterns and maintain patterns in completed Work. Perform Work in a manner which will avoid damage to finished grading and drainage patterns. All damage to finished grading and drainage resulting from Work covered in these Contract Documents shall be repaired at the Contractor's expense.
- G. Existing Utilities: Determine location of underground utilities. Perform Work in a manner which will avoid possible damage. Excavate as required. Maintain grade stakes set by other unless removal is mutually agreed upon by parties concerned. All damage to utilities resulting from Work covered in these Contract Documents shall be repaired at the Contractor's expense.
- H. Existing Conditions: Perform irrigation Work in Tree Protection zones and in existing or previously completed landscape areas to avoid damage and disturbance to these areas. Limit work in these areas to only that necessary to perform work specified herein and shown on the Drawings. Return and repair any areas damaged or disturbed while performing the Work to the existing conditions encountered prior to the Work.
- I. 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:

1. Notify Owner's Representative no fewer than two (2) days in advance of proposed interruption of water service.
 2. Do not proceed with interruption of water service without Owner's Representative written permission.
- J. Removal of Hardscape: Do not remove hardscape surface unless permitted under the following conditions:
1. Coordinate with Owner's Representative no fewer than two (2) days in advance of proposed hardscape removal.
 2. Hardscape removal must not interrupt normal traffic flow on hardscape area.
 3. Area of removal must be useable prior to close of workday and completely repaired within 2 days of removal.

1.9 Coordination

- A. Coordinate installation of irrigation system with Owner's Representative and/or all other trades on site to ensure irrigation system or other work on site will not be damaged. Should contractor fail to coordinate, and damages occur it will be the contractor's responsibility to repair damages at his own costs.

1.10 Extra Materials

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Sprinkler Units: Equal to two (2) percent of amount installed for each type and size indicated, but no fewer than 10 units of each type.
 2. Spray Sprinkler Units: Equal to two (2) percent of amount installed for each type and size indicated, but no fewer than 10 units.
 3. Electric Control Valve Units: Equal to five (5) percent of amount installed for each type indicated, but no fewer than five (5) units of each size and type.
 4. Isolation Valves: Equal to five (5) percent of amount installed for each type indicated, but no fewer than two (2) units of each type.
 5. Decoders: A minimum of 2 units of each type.

1.11 Pre-Installation Meeting

- A. Conduct a virtual conference/meeting. Review methods and procedures related to the site landscape irrigation system including, but not limited to the following.
- B. The General Contractor is to contact the Irrigation Consultant/Landscape Architect and Owner Representative a minimum of 60 days prior to the schedule date of commencement of the irrigation installation.
- C. Meet with Owner Representative and Irrigation Consultant/Landscape Architect to review Contract documents.
- D. Verify current drawing release date with contractor's documents.
- E. Review submittal procedure including codes, substitutions, product data, qualifications, and As-Built procedures and formats.
- F. Review project conditions including tap & meter Size, permits, utility locations and water conditions.
- G. Review methods and procedures related to irrigation installation.
- H. Review and finalize construction schedule and verify availability of materials, contractor's personnel, equipment, and facilities needed to make progress and avoid delays.
- I. Review warranty guidelines.

Part 2 Products

2.1 Manufacturers

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide and warrantee products by one of the manufacturers specified.

2.2 Pipes, Tubes, and Fittings

- A. Steel Pipe: ASTM A 53/A 53M, Schedule 40, Type S or E, Grade A or B, galvanized with threaded ends.
 - 1. Steel Pipe Nipples: ASTM A 733 made of ASTMA 53A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe with threaded ends.

2. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface and female threaded ends.
 3. Gray-Iron Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
 4. Cast-Iron Flanges: ASME B16.1, Class 125.
 5. Cast-Iron Flanged Fittings: ASME B16.1, Class 125, galvanized.
- B. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.
1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
 3. 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.
- C. Hard Copper Tube: ASTM B 88, Type L, water tube, drawn temper.
1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
 3. 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.
- D. PVC Pipe: ASTM D 1785, PVC 1120 compound, Class 200.
1. Pipe 3" and larger to have gasket joint connections. Pipe 2-1/2" and smaller to be bell end.
 2. PVC Socket Fittings, Schedule 40: ASTM D 2466, 2-1/2" and smaller
 3. Ductile Iron Gasket Joint Fittings ASTM A536 for pipe sizes 3" and larger, all ductile iron fittings to have joint restraints as per manufacturer's recommendations.
- E. PVC Pipe: ASTM D 1785, PVC 1120 compound, Schedule 80.
1. PVC Socket Fittings, Schedule 80: ASTM D 2467.

2. PVC Threaded Fittings: ASTM D 2464.

2.3 General-Duty Valves

- A. AWWA, Cast-Iron Gate Valves: AWWA C509, resilient-wedge nonrising-stem, gray- or ductile-iron body and bonnet gate valve, epoxy coated; with steel stem and 2" operating nut.
 1. Minimum: Working Pressure: 200 psig.
 2. End Connections: Mechanical join flanged or ring-tite. Interior Coating: Complying with AWWA C550.
 3. Manufacturers:
 - a. Matco
 - b. Leemco
 - c. Approved Equal
- B. Isolation Valve Boxes: Ten-inch circular valve box with 6" SDR 21 PVC pipe riser from top of valve to center line of valve box. Pipe to be centered on operating nut to allow easy access.
 1. Operating Wrenches: Furnish total of two (2) steel, tee-handle operating wrenches with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.
- C. Bronze Gate Valves: MSS SP-80, Class 125, Type 1, non-rising-stem, bronze body with solid wedge, threaded ends, and malleable-iron hand wheel.
 1. Manufacturers:
 - a. NIBCO INC.
 - b. Approved Equal.

2.4 Specialty Valves

- A. Quick-Couplers: Factory-fabricated, bronze or brass, two-piece assembly. Include coupler water-seal valve; removable upper body with spring-loaded or weighted, rubber-covered cap; hose swivel with ASME B1.20.7, 3/4-11.5NH threads for garden hose on outlet; and operating key.
 1. Locking-Top Option: Vandal-resistant, locking feature. Include four matching keys with hose swivel for each key.
 2. Manufacturers:

- a. Hunter Industries.

2.5 Control-Valve Boxes

- A. Plastic Control-Valve Boxes: Box and cover, with open bottom and openings for piping; designed for installing flush with grade. Size for all valves to be standard 14" rectangular.
 - 1. Shape: Rectangular.
 - 2. Sidewall Material: ABS or HDPE.
 - 3. Cover Material: ABS or HDPE.
 - a. Lettering: IRRIGATION.
 - b. Green in Color.
 - c. Lockable with hex key mechanism or similar.
 - 4. Manufacturers:
 - a. Rain Bird.
 - b. Approved Equal.

2.6 Sprinklers

- A. Description: Plastic housing and corrosion-resistant interior parts designed for uniform coverage over entire spray area indicated, at available water pressure.
 - 1. Manufacturers:
 - a. Rain Bird.
 - b. Hunter for MP-Rotator nozzle.
 - c. Or Approved Equal
 - 2. Pop-up Spray Sprinklers: Fixed or adjustable pattern with screw-type flow adjustment, stainless-steel retraction spring, drain check valve, pressure regulation, co-molded riser seal that seals cap to body and pop-up heights of 4", 6", 12".
 - 3. Pop-up, Rotary Sprinklers: Gear drive, full-circle and adjustable part-circle types with screw-type flow adjustment, stainless-steel retraction spring, stainless steel riser, drain check valve, flow stop valve, minimum of 8 nozzles available, integral rubber cover, adjustable from the top of the sprinkler and pop-up heights of 4", 6", 12".

2.7 Drip Components

- A. Description: Inline Drip Tubing with pressure compensating and check valve emitters. Use manufacturers fittings specifically for specified tubing.
 - 1. Manufacturers:
 - a. Rain Bird.
 - b. Or Approved Equal
- B. Description: Drip Control Zone Kit with pressure regulation, disc filtration, filter cleaning indicator, 220 psi control valve and a pre-assembled package.
 - 1. Manufacturers:
 - a. Rain Bird.
 - b. Or Approved Equal
- C. Description: Drip Indicator. 6" pop-up sprinkler body with yellow indicator on sprinkler pop-up stem.
 - 1. Manufacturers:
 - a. Rain Bird.
 - b. Or Approved Equal
- D. Description: Flush Valve. ½" plastic ball valve with barbed inlet and outlet.
 - 1. Manufacturers:
 - a. Rain Bird.
 - b. Or Approved Equal

2.8 Electric Control Valves

- A. Description: Electrically controlled hydraulically actuated control valves.
 - 1. Manufacturers:
 - a. Rain Bird.
 - b. Or Approved Equal
- B. Features:
 - 1. 24vac solenoid with 410mA inrush current and 280mA holding current.

2. Pressure rating of 220 psi.
3. Fabric reinforced diaphragm.
4. Internal and external bleed.
5. Flow control handle.
6. Contamination Resistant.

2.9 Automatic-Control System

- A. Manufacturers:
 1. Baseline
 2. Or Approved Equal
- B. Exterior Control Enclosures: NEMA 250, Type 4, weatherproof, with locking cover and two matching keys; include provision for grounding.
 1. Material: Enameled-steel or stainless steel.
 2. Mounting: Surface type for wall mounting, concrete mounting base for pedestal.
- C. Control Transformer/Decoder Output: 24VAC 4A secondary, with overload protection and or primary fuse.
 1. Decoder Line Output: 32 VAC RMS over 2-wire path
 2. Solenoid Capacity: 2 standard 24VAC solenoids per output, maximum output of 14 simultaneously.
- D. Controller Stations for Automatic Control Valves: Each station is variable from approximately 1 minute to 23.9 hours. Include switch for manual or automatic operation of each station.
- E. Timing Device: Adjustable, 24-hour, 365-day clock, with automatic operations to skip operation any day in timer period, to operate every other day, odd-even days, interval days, to operate 8 or more times daily.
 1. Manual or Semi-automatic Operation: Allows this mode without disturbing preset automatic operation.
 2. Minimum 30-day internal power storage: Automatically powers timing device during power outages.
 3. Eight (8) start times.

4. Simultaneous program operation.
5. Test program.
6. One button manual start.
7. Seasonal adjust 25% to 200%.
8. Ninety-nine (88) independent programs.
9. Surge Protection: Metal-oxide-varistor type on each station and primary power.
10. Rain Sensor compatible with over-ride capabilities.
11. Remote control capabilities.
12. Six (6) Master Valve and Flow Meter input.
13. Flow monitoring by station.
14. Soil Moisture sensor compatible.
15. Remote access from internet enabled device.
16. ET based irrigation scheduling.
17. Moisture Sensor based irrigation scheduling.

F. Wiring:

1. Manufacturers:
 - a. Paige Electric.
 - b. Or Approved Equal
2. Feeder-Circuit Cables: No. 14 AWG minimum, between building and controllers.
3. Decoder Output Cable: No. 14 Paige #P7072D "Maxi Cable".
4. Splicing Materials: 3M DBY-6 as required by manufacturer.

Part 3 Execution

3.1 General

- A. Observation of Work in Progress: During the installation, the Landscape Architect/Irrigation Consultant will make regular site visits and reject any work and materials which do not meet the requirements called for in the Contract Documents.
- B. Inspect project site prior to start of Work to determine that all site conditions are acceptable for Work to begin. Inform Landscape Architect/Irrigation Consultant of unsuitable conditions. Do not proceed with installation of the irrigation system until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
- C. Locate all existing underground utilities prior to trenching and/or boring operations and protect them against damage during the Work. Obtain utility location from Owner and/or General Contractor and utilize utility locating services when necessary.

3.2 Examination

- A. Investigate and determine available water supply, water pressure and flow characteristics.
- B. When unanticipated utilities that conflict with the intended function or design are encountered, investigate, and measure the nature and extent of the conflict. Promptly submit a written report to the Owner for action.

3.3 Earthwork

- A. Install warning tape directly above pressure piping, 12 inches below finished grades, except 6 inches below subgrade under pavement and slabs.
- B. Install piping and wiring in sleeves under sidewalks, roadways, parking lots, and railroads.
 - 1. Install piping sleeves prior to hardscape sub-base being installed if possible.
 - 2. Sleeving installed in open trench to be completely backfilled crushed limestone, approved by owner's representative and compacted to insure no future settling.
 - 3. Pipe sleeves are to be a minimum of two times the diameter of the pipe in the sleeve.
- C. Provide minimum cover over top of underground piping according to the following:
 - 1. Irrigation Main Piping: Minimum depth of 18 inches from top of pipe to finished grade.

2. Circuit Piping: 12" within general landscape areas, piping to be a minimum of 3 inches laterally\vertically from any other pipe or conduit at all times.
3. Drain Piping: 12 inches.
4. Sleeves: 18 inches from top of pipe for mainlines and 12 inches from top of pipe for laterals.

3.4 Excavation Preparation

- A. Set stakes to identify locations of proposed irrigation system. Obtain Owner's Representative's approval before excavation.
- B. Excavate area for pipe installation 4" wider than diameter of pipe.
 1. Level trench base to insure consistent contact of pipe to trench bottom.
 2. Remove all rocks and other sharp objects.
 3. Place pipe in trench snaking from side to side if possible.
 4. Backfill to the top of pipe compacting the sides.
 5. Backfill in 8" lifts compacting to 90% between lifts until complete.
 6. All trenches greater than 4" in width to be restored to grade, +- 1/4", with sod as approved by owner's representative.
 7. All trenches 4" or small in width to be restored to grade, +- 1/4" with a minimum of 3" of topsoil as approved by owner's representative.
 8. Whenever possible trenching should be outside of a tree dripline. If trenching is done within the dripline it should be at least 10' from existing tree, if 10' is not possible the trenching must be done by hand and all tree roots greater than 1" to be left in place. All tree roots 1" or less may be removed by saw cutting root on either side of the excavation and root removal.

3.5 Piping Applications

- A. Install components having pressure rating as shown on the plan.
- B. Piping in above ground may be joined with flanges instead of joints indicated.
- C. Aboveground Irrigation Main Piping: Use the following piping materials for each size range:
 1. NPS 3 and Larger: Steel pipe; malleable-, gray-, or cast-iron fittings; and threaded joints.

2. NPS 25 and Smaller: hard copper tube, wrought- or cast-copper fittings, and soldered joints.
- D. Underground Irrigation Main Piping: Use the following piping materials for each size range:
1. NPS 25 and Smaller: Class 200, PVC, pressure-rated pipe; Schedule 40, PVC socket fittings; and solvent-cemented joints.
 2. NPS 3 and larger: Class 200 PVC, pressure rated pipe with gasket joint ends, Ductile Iron gasket joint fittings with manufacturer's recommended joint restraint.
- E. Circuit Piping: Use the following piping materials for each size range:
1. NPS 4 and Smaller: Class 200, PVC, pressure-rated pipe; Schedule 40, PVC socket fittings; and solvent-cemented joints.
- F. Underground Branches and Offsets at Sprinklers and Devices: Schedule 80, PVC pipe; acme threaded o-ring sealed PVC fittings.
1. Option: Plastic piping manufactured for this application may be used on sprinkler inlets of 1/2" or smaller instead of pipe and fittings specified, "swing pipe and spiral barbed elbows). If this is to be used the offset must be more than 12" and less than 18" as per detail.
- G. Risers to Aboveground Sprinklers and Specialties: Type L hard copper tube, wrought-copper fittings, and soldered joints.
- H. Sleeves: SCH 40 PVC pipe and socket fittings; and solvent-cemented joints.
- I. Transition Fittings: Use transition fittings for plastic-to-metal pipe connections according to the following:
1. Couplings:
 - a. Underground Piping NPS 2-1/2 and Smaller: Manufactured fitting or coupling.
 - b. Underground Piping NPS 3 and Larger: PVC Flange with stainless steel bolts and rubber gasket.
 2. Fittings:
 - a. Aboveground Piping: Plastic-to-metal transition fittings.
 - b. Underground Piping: Union with plastic end of same material as plastic piping.

- J. Dielectric Fittings: Use dielectric fittings for dissimilar-metal pipe connections according to the following:
 - 1. Underground Piping:
 - a. NPS 2 and Smaller: Dielectric couplings or dielectric nipples.
 - b. NPS 2-1/2 and Larger: Prohibited except in valve box.
 - 2. Aboveground Piping:
 - a. NPS 2 and Smaller: Dielectric unions.
 - b. NPS 2-1/2 to NPS 4: Dielectric flanges.
 - 3. Piping in Valve Boxes or Vaults:
 - a. NPS 2 and Smaller: Dielectric unions.
 - b. NPS 2-1/2 to NPS 4: Dielectric flanges.

3.6 Valve Applications

- A. Aboveground, Shutoff-Duty Valves:
 - 1. NPS 2 and Smaller: Bronze gate valve.
 - 2. NPS 2-1/2 and Larger: Cast-iron, nonrising-stem gate valve.
- B. Isolation Valves:
 - 1. NPS 2 and Smaller: Bronze nonrising-stem gate valve.
 - 2. NPS 2-1/2 and Larger: Cast-iron, nonrising-stem gate valve with 2" operating nut.

3.7 Piping Installation

- A. Location and Arrangement: Drawings indicate suggested location and arrangement of piping systems. Install piping as indicated unless deviations are approved by Owner's Representative.
- B. Install piping free of sags and bends.
- C. Install groups of pipes parallel to each other with a space between minimum of 4", spaced to permit single valve removal and or servicing.
- D. Install fittings for changes in direction and branch connections.
- E. Install dielectric fittings to connect piping of dissimilar metals.

- F. Install underground thermoplastic piping according to ASTM D 2774 and ASTM F 690.
- G. Lay piping on solid subbase, uniformly sloped without humps or depressions.
- H. Install PVC piping in dry weather when temperature is above 32 deg F 5 deg C. Allow joints to cure at least 24 hours at temperatures above 32 deg F 5 deg C before testing unless otherwise recommended by manufacturer.
- I. Install water regulators with shutoff valve and strainer on inlet and pressure gage on outlet. Flush the line prior to installation to remove debris. Install the valve so that the flow arrow marked on the valve body tag corresponds to the flow through the line. Install shutoff valve on outlet.

3.8 Valve Installation

- A. Electrical Control Valves: Install in valve box with top flush with and perpendicular to grade.
 - 1. All electrical control valve boxes to be 14" rectangular valve box.
 - 2. From bottom of valve to a depth of 6" install washed stone or gravel sized between $\frac{3}{4}$ " and 1" in diameter to create sump and stabilize valve box.
 - 3. Install valve box extensions as necessary to bring lid level with finished landscape grade.
 - 4. Control Valves to be installed with center line of valve 12" below finished grade.
- B. Underground, Manual Control Valves: Install with 6" SDR 21 PVC riser from top of pipe to center line of valve box finishing with 10" round valve box level with finished landscape grade.
 - 1. Install valves and PVC pipe with restrained, gasketed joints as necessary at the same depth as the mainline pipe.

3.9 Sprinkler Installation

- A. Flush circuit piping with full head of water prior to installing sprinklers.
- B. Install sprinklers at manufacturer's recommended heights perpendicular to grade.
- C. Locate part-circle sprinklers to maintain a minimum distance of 4 inches from walls and 2 inches from other boundaries, unless otherwise indicated.
- D. Adjust all sprinklers to irrigated plant material indicated for the station.

3.10 Drip Component Installation

- A. All dripline to be installed on FG. Flush all dripline tubing prior to covering with mulch. Install dripline in grid fashion as per plan details and manufacturers recommendations.
- B. Install drip control zone kit as per valve installation specification 3.09.A and plan detail.
- C. Install Drip Indicator as per specification 3.10.B and plan detail.
- D. Install Drip Flush Valves in a 10" valve box as per plan detail.

3.11 Automatic-Control System Installation

- A. Obtain approval of controller location from owner's representative prior to installation. Install wall mount controller level and at eye level. Securely fasten controller to wall with metallic fasteners appropriate for wall type or install pedestal controller on concrete pad with all necessary conduit installed through the pad to accommodate all wire to controller. All irrigation control wire between controller and finished grade to be in PVC electrical conduit.
- B. Install control wire conduit in same trench as mainline piping and at least 4 inches to the side of the piping. Provide conductors of size not smaller than recommended by controller manufacturer. Install wire in separate sleeve under paved areas if irrigation piping is installed in sleeve. All wire splices to be in minimum 10" round valve box.

3.12 Connections

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Ground equipment according to ASIC Grounding Guidelines www.aisc.org. Resistance readings to ground to be as recommended by the manufacturer. If there are no manufactures requirements, then the controller should have a resistance of 10 ohms or less.
- C. 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.

3.13 Field Quality Control

- A. Perform the following field tests and inspections and prepare test reports:
 - 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, operate controllers and automatic control valves to confirm proper system operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
4. Remove and replace units and retest and re-inspect as specified above.

3.14 Startup Service

- A. Engage a factory-authorized service representative to perform startup service of control system.
- B. Verify that controllers are installed and connected according to the Contract Documents.
- C. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 26 Sections.
- D. Complete startup checks according to manufacturer's written instructions.

3.15 Adjusting

- A. Program controller(s) to ensure adequate moisture is available for the root zone of the plant. Insure there is no run-off, over watering or deep percolation. Ensure controller operates within irrigation window as defined by Owner's Representative or local governing authorities. See additional controller programming notes on plans provided.
- B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit. Use pressure regulation for each control valve if pressure is higher than recommended for the sprinklers in the circuit.
- C. Adjust sprinklers so they will be 1/8 inch above finish grade in sodded lawns and 1/2 inch above grade in seeded lawns. In shrub beds adjust sprinklers to insure top of sprinkler is at finished mulch levels.
- D. Adjust sprinklers arc and radius to ensure no water is sprayed outside of the irrigated area.

3.16 Cleaning

- A. Flush dirt and debris from piping before installing sprinklers and other devices.

3.17 Demonstration

- A. It is contractors' responsibility to train Owner's maintenance personnel to adjust, operate, and maintain sprinklers, isolation valves, controllers, and automatic control valves.

- B. OBSERVATION AND ACCEPTANCE
- C. Periodic site visits will be made by the Landscape Architect\Irrigation Consultant to review the quality and progress of the work. Work found to be unacceptable must be corrected within five (5) calendar days. Remove rejected materials promptly from the project.
- D. Upon completion of the Work, the Contractor shall notify the Landscape Architect and Owner at least ten (10) days prior to requested date of the site visit for Substantial Completion of all portions of the Work. Landscape Architect\Irrigation Consultant will issue a punch list for all work to be corrected. All work on the punch list must be complete within five (5) working days from the date of the site visit. Where Irrigation Work does not comply with the requirements, replace rejected Work. If such replacements are not completed within the time specified, the Irrigation Contractor may be considered to be in default of the Contract, and the Owner may use the Contract Retainage to hire other Contractors to finish the work.
- E. It will be the responsibility of the Irrigation Contractor to provide reliable communication system (remote control or two-way radios) for Substantial Completion and all periodic site visits.
- F. If a site visit to verify Substantial Completion has been scheduled and the Landscape Architect\Irrigation Consultant arrives at the site and determines that the irrigation system is not substantially complete (all system components in place, operational and checked) the Contractor will be responsible for all expenses included but are not limited to the following: mileage, airfare, consultant's time, parking fees, meals, car rental, etc. All incurred expenses will be deducted from the final contract amount.

END OF SECTION

Natural Turf Sports Field Construction and Laser Grading

Part 1 General

1.1 Work Included

- A. The work called for by this section shall include, but not necessarily be limited to preparation of subgrade, finish grading and the spreading and shaping of topsoil to the finished contour elevations indicated by the drawings for the natural turf sports fields.
- B. Refer to other sections for work related to that specified under this heading. Coordinate this work with that specified by other sections for timely execution.

Part 2 Products

2.1 Soils

- A. **TOPSOIL:** Use imported topsoil as specified Section 32 91 13.19 Planting Soils and elsewhere. Topsoil furnished shall be natural, fertile, containing sufficient organic material and other elements as required to promote healthy plant growth, and be friable soil possessing characteristics of representative productive soils in the vicinity. It shall be obtained from naturally well drained areas. It shall be a sandy loam soil. It shall not be excessively acid or alkaline nor contain toxic substances that may be harmful to plant growth. Topsoil shall be without admixture of subsoil and shall be cleaned and reasonably free from clay lumps, stones, stumps, roots, or similar substances 1/2 inches or more in diameter (screen topsoil if necessary to meet this requirement), debris, or other objects that are a hindrance to planting operations and/or presents a safety or playability issue with the fields. Samples of topsoil shall be submitted to A/E for approval. Topsoil is to be tested to indicate pH value, fertilization requirements along with relevant micronutrient information for the specified turf grass.
- B. **SUB-SURFACE SOIL:** The soil directly below the topsoil shall be either existing compacted soil or imported material or both. It shall be properly compacted to provide a uniform base for the topsoil and of sufficient character as to provide an adequate root zone medium.
- C. **SAND:** United States Golf Association (USGA) greens sand or approved equal.
- D. **INFIELD MATERIAL:** See Note 3 Sheet L7.01 for Infield material.

Part 3 Execution

3.1 Preparation of Fields

- A. Do not begin work until the earth is dry enough to be tillable. Install fields a minimum of thirty (30) days prior to sprigging and/or sodding to allow settling and germination of any weed seeds.

- B. Inspect subgrades to see that they generally conform to the standards called for elsewhere in these specifications, particularly with regard to the approximate depths required for the work. After work is completed, inspect it to ensure that all finish grading complies with design requirements. Do not over compact sub-surface soil. This soil shall be evenly compacted.
- C. Place finished grade stakes wherever necessary to bring the work accurately to the elevations required by the drawings.
- D. Till the field(s) with a disc harrow 6" - 8" into the subsurface a minimum of 3 times.
- E. Remove small loose rocks, stones, and debris, using a RockHound or equivalent as required, thereby causing the subsurface soil to be reasonably free of such miscellaneous matter.
- F. Laser grade the subsurface to within +/- one-half inch (1/2") of the designated slopes and elevations. Automatic laser controlled systems and equipment shall be used for laser grading.
- G. Adjust locations of irrigation heads along infield transition as needed and cap existing irrigation that is to be abandoned. For sports fields where underground drainage is to be installed, repair irrigation main and lateral lines. Re-compact trenches and other excavations to prevent future settling. The depth and height of installation is subject to the final grade.
- H. Spread minimum of 4 inches (4") of topsoil or as noted in drawings and grade based on designated thickness and locations (initial placement/spreading of the topsoil can be by the grading contractor).
- I. Add sand, as a leveling course, as needed to aid in the laser grading of the fields.
- J. Add, subject to soil conditions and soil test, a minimum of one ton (1T) of 5-10-15 fertilizer and two tons (2T) of lime per acre and evenly distribute.
- K. Lightly blend the topsoil, sand, lime and fertilizer into the previous tilled and laser graded subsurface, thereby creating the root zone with a loose consistency. Laser grade to within +/- one-fourth inch (1/4") of designated slopes and elevations.
- L. For the baseball/softball fields, lightly scarify/groove the infield subgrade surface to help bond the subgrade to the infield material. Install a total of four inches (4") of infield material onto the subgrade in two, two inch (2") lifts. Compact the first 2" lift to 90-95% Standard Proctor; add additional material as necessary to achieve a 2" depth and re-compact as necessary. Lightly scarify/groove the surface to help bond the infield material lifts add an additional lift of two inches (2") of infield material and compact to 90-95%, adding material as needed to achieve a full 4" compacted depth. Laser grade the surface within +/- one-fourth inch (1/4") of the designated slopes and elevations. The Owner has contracted with a testing provider for compaction testing, coordinate testing to validate the specified compaction of the infield material. Install home plate, pitcher's rubber, bases and foul poles as required per specifications.

- M. Install the sprinkler heads even with the surface and carefully re-compact around the heads to prevent future settling. Provide a 2' square sod strip around each sprinkler head; recess sod so as not to create a mound. Top of the irrigation head is to be placed such that it is not a tripping hazard or can be "nicked" by lawn maintenance equipment. The irrigation system shall be tested and its proper operation thoroughly confirmed and demonstrated prior to installing the sprigs and/or sod.
- N. Prior to the installation of sprigs or sod, treat all emerged weeds with Roundup Pro @ 3 qts/acre or approved equal.
- O. Coordinate sprigging or sodding with installation of lighting, fencing, and other structures such as dugouts, bullpens and batting cages as required and all per the designated specifications in the appropriate sequence, fencing typically being last.
- P. Dispose of excess excavated materials and debris away from the site.
- Q. Reset bases.

END OF SECTION

Part 1 General

1.1 Summary

- A. This scope of work includes, but is not limited to, all labor, materials, equipment, transportation, and services necessary for, and incidental to performing all operations with salvaging, amending, and placing Planting Soils as shown on the drawings and as specified herein.
- B. The scope of work in this section includes, but is not limited to, the following:
1. Locate, purchase, deliver and install soil amendments and furnished soil, as needed.
 2. Salvage and stockpile existing site soils suitable for Planting Soils.
 3. Modify existing site soil.
 - a. Modify existing site soil in place for use as Planting Soils.
 - b. Modify existing site soil within critical root zone.
 4. Amend salvaged existing soil for use as Planting Soils and place.
 5. Importing Furnished Soil for Sports Field Construction.
 6. Install Mulch and/or Compost over soil surface.
 7. Fine grade Planting Soils.
 8. Clean up and disposal of all excess and surplus material.
- C. Related Specifications and References:
1. Section 31 20 00 Earth Moving
 2. Section 32 90 01 Natural Turf Sports Field Construction and Laser Grading
 3. Section 32 92 00 Lawns and Grasses
 4. Section 32 93 00 Trees, Plants, and Ground Covers
- D. Related References:
1. ASTM: American Society of Testing Material cited section numbers.
 2. S. Department of Agriculture, Natural Resources Conservation Service, 2003. National Soil Survey Handbook, title 430-VI. Available Online.

3. S. Composting Council <https://www.compostingcouncil.org>

1.2 Definitions

- A. Amendment: Material added to soil to produce soil mix such as mulches or compost.
- B. Biological Amendment: Amends used to enhance the biological characteristics of the soil such as Mycorrhizal additives.
- C. Compacted soil: Soil where the bulk density is greater than the threshold for root limiting, and as further defined in this specification.
- D. Compost: Well decomposed stable organic material as defined by the US Composting Council, and as further defined in this specification.
- E. Existing soil which has been stripped and stockpiled: In-situ mineral soil present on site, and as further defined in this specification.
- F. Fine grading: Final grading of the soil to achieve proposed contours, and as further defined in this specification.
- G. Finished grade: Surface of elevation of Soils after final grading and 12 months of settlement, and as further defined in this specification.
- H. Scarify: Loosening and roughening the surface of subsoil prior to placing additional soil on top, and as further defined in this specification.
- I. Subsoil: Subsurface horizon or layer immediately below the topsoil, and as further defined in this specification.
- J. Subsoiling: Loosening the subsoil by using a backhoe or by dragging a ripping shank or chisel thru the soil to depths of 18-24 inches or as specified, and as further defined in this specification.
- K. Tilling: Loosening the topsoil with a rotary tine tilling machine, roto tiller, or spade tiller to depths of 6 inches or as specified, and as further defined in this specification.
- L. Topsoil: Soil surface horizon or layer, and as further defined in this specification.
- M. Undisturbed soil: Areas of soil with a topsoil that have not been graded or compacted.
- N. Sport Field Soil: Soils to be imported for sports field construction.

1.3 Submittals

- A. Product data and certifications: For each Planting Soil product, submit data and/or certificates that product meets the specification requirements, signed by the product manufacturer/supplier. Product data and certifications are required from each manufacturer/supplier, particularly when sources are changed.

- B. Testing of furnished products is required at the following intervals:
 - 1. Test every 400 cubic yards (CY) prior to placement or at a change in manufacturer/supplier.
- C. Submit information identifying manufacturer/sources of all Planting Soil products.
 - 1. The Owner's Representative shall have the right to reject any manufacturer/supplier.
 - 2. Submit manufacturer/supplier name, address, telephone and fax numbers and contact name.
 - 3. Submit certification that accepted manufacturer/supplier is able to provide sufficient quantities of Planting Soil product(s) for the entire or a defined portion of the project.
- D. Representative Samples: Submit for each of the following to the Owner's representative for approval, prior to ordering or using the Planting Soil products:
 - 1. Sports Field Soil Mix, two-gallon sample from source. The sample shall be a mixture of random samples taken from the source stockpile or field and include relevant testing information for soil classification, ph, organic matter content, etc.
 - 2. Planting Soil Mix: Submit proposed amendments for modifying existing soils to meet planting requirements for non-sports field turf areas and planting areas as required herein.

1.4 Quality Assurance

- A. Soil testing laboratory qualifications include an independent laboratory with experience and capability to conduct testing indicated herein and that specialize in USDA agricultural soil testing.
- B. Compost testing laboratory qualifications include an independent, US Composting Council STA Program certified lab for compost testing. Verifying current participation in the STA program can also be achieved by logging onto the USCC website at <https://www.compostingcouncil.org/page/CertifiedLabs>.
- C. All modified, furnished and installed Planting Soil products shall conform to the approved submittal's test analysis. Any Planting Soil products that fails to meet the criteria shall be modified or removed from the site and new soil installed if requested by the Owner's Representative.
- D. Following installation of planting mixes and/or modification of existing soil, test soil compaction with a penetrometer.
 - 1. Maintain at the site at all times a soil cone penetrometer with pressure dial and a soil moisture meter to check soil compaction and soil moisture.

- a. Penetrometer shall be AgraTronix Soil Compaction Meter distributed by Ben Meadows, www.benmeadows.com or an approved equal.
 - b. Moisture meter shall be "general digital soil moisture meter" distributed by Ben Meadows, www.benmeadows.com or an approved equal.
2. Prior to testing the soil with the penetrometer check the soil moisture and penetrometer readings in the soil. Penetrometer readings are impacted by soil moisture and excessively wet or dry soils will read significantly lower or higher than soils at optimum moisture.
 3. The penetrometer readings shall be within 20% plus or minus of the reading in the approved mockup when at similar moisture levels.

1.5 Soil Compaction

- A. Bulk density method, standard proctor method ASTM D 698 and penetrometer resistance method are all common ways to measure, quantify and assess levels of compaction. This specific requires the penetrometer resistance method and equate it to the standard proctor method.
- B. The following parameters shall define the general description of threshold points of soil compaction in existing, modified, and installed soil and subsoil.
 1. Penetrometer Resistance Method uses a penetrometer to measure compaction in PSI (pressure per square inch). Soil moisture shall be measured at the same time to ensure moisture is within the allowable range for compaction testing.
- C. The following are penetrometer resistance thresholds for levels of compaction:
 1. Acceptable Compaction: Good rooting anticipated, but increasing settlement expected as compaction is reduced and/or organic matter is increased. Approximately 75-250 PSI.
 2. Root limiting Compaction: Root grow is limited with fewer, shorter, and slower growing roots. Approximately 300 PSI.
 3. Excessive Compaction: Roots not likely to grow but can penetrate soil when soil moisture is above field capacity. Approximately greater than 400 PSI.

1.6 Delivery, Storage and Handling

- A. In addition, the following provision is established: Material shall not be handled or hauled, placed, or compacted when it is wet as after a heavy rainfall or is frozen. Soil shall be handled only when the moisture content is less than at field capacity. The Owner's Representative shall be consulted to determine if the soil is too wet to handle.

- B. Store and handle packaged materials in strict compliance with manufacturer's instructions and recommendations. Protect all materials from weather, damage, injury and theft.
- C. Prohibit vehicular and pedestrian traffic on or around stockpiled planting soil.
- D. Soil that is to be stockpiled longer than two weeks, whether on or off site, shall not be placed in mounds greater than ten feet high. If soil stockpiles greater than ten feet high are present longer than two weeks, then the contractor shall break down and disperse soil so that mounds do not exceed the ten-foot height restriction for longer than two weeks.
- E. Vehicular access to the site is restricted. Before construction, the Contractor shall submit for approval a plan showing proposed routing for deliveries and site access. No vehicular traffic is allowed on the sports fields once compaction of subgrade has been established.

Part 2 Products

2.1 Sports Field Soil Mix

- A. Topsoil furnished shall be natural, fertile, containing sufficient organic material and other elements as required to promote healthy plant growth, and be friable soil possessing characteristics of representative productive soils in the vicinity. It shall be obtained from naturally well drained areas. It shall be a sandy loam soil. It shall not be excessively acid or alkaline nor contain toxic substances that may be harmful to plant growth. Topsoil shall be without admixture of subsoil and shall be cleaned and reasonably free from clay lumps, stones, stumps, roots, or similar substances 1/2 inches or more in diameter (screen topsoil if necessary to meet this requirement), debris, or other objects that are a hindrance to planting operations and/or presents a safety or playability issue with the fields. Samples of topsoil shall be submitted to A/E for approval. Topsoil is to be tested to indicate pH value, fertilization requirements along with relevant micronutrient information for the specified turf grass.
- B. Planting Soil Mix for Non-sports field turf areas shall be mixes of Existing Stockpiled Soil and amendments (Topsoil, Compost, Fertilizer, Pine Bark Nuggets and other additives) to make new soil that meets the project goals for the indicated planting area as noted below. Planting Soil Mix for Non-sports field turf areas modification shall meet the following physical and chemical criteria:
 - 1. Soil texture: USDA loam, sandy loam
 - 2. pH value: 5.5-8.0
 - 3. Percent organic matter (OM): 1-5% by dry weight
 - 4. Soluble salt level: less than 2.0 mmhos/cm

C. General requirements for all modifications:

1. Take soil samples of existing soil, test for chemical and physical properties, test compaction, and make appropriate adjustments. Submit test results to Owners Representative.
2. All soil grading, subsoiling, and tilling must be completed at times when soil moisture is below field capacity.

2.2 Planting Soil for Tree Pits and Planting Beds

- A. Planting Soil for Tree Pits shall be modified existing topsoil for use in pits of large tree stock and planting beds. Locations to be determined based on proposed planting plan. They may be mixed off site or onsite.
- B. Planting soil for tree pits and planting beds shall be amended to meet the following physical and chemical criteria:
1. Soil texture: USDA loam, sandy loam
 2. pH value: 5.5-7.0
 3. Percent organic matter (OM): 4-10% by dry weight
 4. Soluble salt level: less than 2.0 mmhos/cm

2.3 Compost

- A. Compost: Compost shall be a well decomposed, stable, weed free organic matter source. It shall be derived from leaves or yard waste. The compost shall be composted for a minimum of 9 months and at temperatures sufficient to break down all woody fiber, seeds, and leaf structures. The compost shall be free of debris such as plastics, metal, concrete or other debris. The compost shall be free of stones larger than 1/2", larger branches and roots. The compost shall be a dark brown to black color and be capable of supporting plant growth with appropriate management practices and other amendments as applicable, with no visible free water or dust, with no unpleasant odor.
- B. Compost shall be commercially prepared and meet the US Composting Council (USCC) Seal of Testing Assurance (STA) program.
- C. Compost shall meet the following parameters:

Parameters ¹	Reports as (units of measure)	General Range
pH	pH units	6.0-8.5
Soluble Salt Concentration (electrical conductivity)	dS/m (mmhos/cm)	Maximum 10
Moisture Content	%, wet weight basis	30-60
Organic Matter Content	%, dry weight basis	30-65 ²
Particle Size	% passing a selected mesh size, dry weight basis	Minimum of 98% pass through ¾" screen or smaller

Parameters ¹	Reports as (units of measure)	General Range
Bulk Density	pounds/cubic yard	Unit only needed for estimating application rate of organic amendment.
Chemical Contaminants ³	Mg/kg (ppm)	Meet or exceed US EPA Class A standard, 40 CFR 503.13, Tables 1 and 3 levels
Biological Contaminants ⁴ Select Pathogens Fecal Coliforms Bacteria, or Salmonella	MPN per gram per day dry weight; MPN per 4 grams per dry weight	Meet or exceed US EPA Class A standard, 40 CFR 503.32(a) levels
¹ Recommended test methodologies are provided in Test Methods for the Examination of Composting and Compost (TMECC, The US Composting Council) ² This is the typical range of organic matter content found in compost. An organic matter content greater than 65% would also be acceptable. ³ US EPA Class A Standard, 40 CFR 503.13, Table 1 and 3 levels = Arsenic 41 ppm, Cadmium 39ppm, Copper 1,520ppm, Lead 300ppm, Mercury 17ppm, Molybdenum 75ppm, Nickel 420ppm, Selenium 100ppm, Zinc 2,800ppm. ⁴ US EPA Class A standard, 40 CFR 503.32(a) levels = Salmonella <3 MPN/4 grams of total solids or Fecal Coliform <1000 MPN/gram of total solids.		

2.4 Mulch

- A. Mulch: Refer Section 32 92 00 Lawns and Grasses, Section 32 93 00 Trees, Plants, and Ground Covers, and Planting Details.

Part 3 Execution

3.1 Coordination with Project Work

- A. The Contractor shall coordinate with all other work that may impact the completion of the Planting Soil work. Prior to start of work, the Contractor shall prepare a detailed schedule of the work for coordination with other trades/work (i.e. utilities, buildings, paths, etc.).

3.2 Existing Soil Modification

- A. Follow the requirements for modifying existing soil as indicated in Part 2.

3.3 Planting Soil Installation for Planting Soil Mix and Furnished Soil for Tree Pits

- A. In areas of soil installation above existing subsoil, scarify the subgrade prior to installing Planting Soil Mix or Furnished Soil for Tree Pits.
- B. Limit paths of construction vehicle traffic to reduce the impact of compacting in Planting Soils.
- C. Depths and grades shown on the drawing are final grades after settlement and shrinkage of compost material. The Contractor shall install the Planting Soils at a higher level to anticipate this settlement. A minimum settlement of approximately 10-15% of soil depth is expected. All grade increases are assumed to be measured prior to addition of surface Compost or Mulch.

3.4 Fine Grading

- A. The Owner's Representative shall approve all rough grading prior to the fine grading, planting and mulch or compost over finished grade.
- B. Grade the finished surface to meet the finished grades shown on the drawings, allowing the finished grade to remain higher (10-15% of depth of soil modification) than the grade on the grading plan to anticipate settlement over the first year.
- C. Utilize hand equipment, small garden tractors with rakes or teathed buckets, or equipment with low ground pressure tires to keep surface rough without further compaction. Do not use equipment that will smooth, compress and/or compact the finished grade.
- D. Provide smooth, rounded transitions between slopes of different gradients and direction unless otherwise shown on drawings or directed by the Owner's Representative.

3.5 Cleanup

- A. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or compacted due to subsequent construction operations or weather conditions. Scarify or remove and replace material to a depth as directed by the Lead Landscape Architect; reshape at optimum moisture content to the required density.
- B. Remove and dispose of all excess Planting Soil products and other material brought onsite by the Contractor.

3.6 Substantial Completion Acceptance

- A. The Owner's Representative shall review the Planting Soil work and make a determination if the work is substantially complete upon written notice from the Contractor.

3.7 Final Acceptance/Soil Settlement

- A. At the end of the plant warranty and maintenance period, the soil installation work and establish all provisions of the contract are complete and work is satisfactory.
- B. The Contractor shall restore any soil settlement and/or erosion areas to grades shown on the drawings. When restoring grades, remove plants and mulch/compost and add appropriate Planting Soil before restoring the planting and mulch/compost over the finished grade. Do not place additional soil over the root balls of plants, on top of plants or on top of mulch/compost.

END OF SECTION

Part 1 General

1.1 Summary

- A. Provide all materials and equipment, and do all work required to complete the seeding and sodding of lawn areas, including removal of existing vegetation, grading, furnishing, and placing planting soil, as indicated on the Drawings and as specified.
 - 1. Extent of sod and seed areas will be reviewed and approved by Design Professional and Owner prior to commencement of Work of this Section.
 - 2. The placement of the sod shall be sequenced in such a manner as to allow proper root growth and establishment prior to the completion of the project and acceptance by the Owner.
 - 3. See section 32 90 01 Sports field Construction and Laser Grading for sodding of Sports field areas.

1.2 Related Work

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
 - 1. Section 31 20 00, Earthwork; Establishment of subgrade elevation.
 - 2. Section 32 84 00.01, Irrigation System.
 - 3. Section 32 90 01, Natural Turf Sports Field Construction and Laser Grading
 - 4. Section 32 91 13.19 Planting Soils
 - 5. Section 32 92 00, Lawns and Grasses
 - 6. Section 32 93 00, Trees, Plants, and Ground Covers;.

1.3 References

- A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. American Society for Testing and Materials (ASTM):
 - a. C 136 Sieve Analysis of Fine and Coarse Aggregates
 - b. D 422 Particle-Size Analysis of Soils

- c. E 11 Wire-Cloth Sieves for Testing Purposes
- 2. American Sod Producers Association –Guideline Specifications for:
 - a. Sodding: FSO-F-241 Fertilizers, Mixed, Commercial

1.4 Submittals

- A. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
 - 1. Certification of each seed mixture for turfgrass sod, identifying source, including name and telephone number of supplier.
- B. Topsoil Sample: Submit 1 quart of topsoil proposed for use.
- C. Soil Mix Sample: Submit 1 quart of each proposed soil mix, including the components of the soil mix.
- D. Soil Report: Submit results of laboratory soil tests of on-site soil and proposed topsoil for soil mix.
- E. Fertilizer Analysis (to be used in soil mix and on lawn areas): Submit label or technical data for fertilizer bearing the trade name, manufacturer's name, weight and analysis.
- F. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of lawns during a calendar year. Submit before expiration of required initial maintenance periods.

1.5 Owner's Inspection and Testing

- A. Work will be subject to inspection at all times by the Design Professional. The Owner reserves the right to engage an independent testing laboratory in accordance with requirements of Division 01 to analyze and test materials used in the construction of the work. Where directed by the Design Professional, the testing laboratory will make material analyses and will report to the Design Professional whether materials conform to the requirements of this specification.
 - 1. Cost of tests and material analyses made by the testing laboratory will be borne by the Owner when they indicate compliance with the specification, and by the Contractor when they indicate non-compliance.
 - 2. Testing equipment will be provided by and tests performed by the testing laboratory.
 - 3. Upon request by the Design Professional, shall provide such auxiliary personnel and services needed to accomplish the testing work.

4. Gradation of granular materials shall be determined in accordance with ASTM C 136.
5. Sieves for determining material gradation shall be as described in ASTM E 11.

1.6 Contractor's Inspection and Testing

A. The Contractor shall engage an independent testing agency, experienced in the testing of agricultural soils and acceptable to the Design Professional, to perform the topsoil/planting soil tests and analyses specified herein. All costs associated with testing shall be the Contractor's responsibility.

1. Particle size analysis shall include the following gradient of mineral content:

<u>USDA Designation</u>	<u>Size in mm</u>
Gravel	+ 2 mm
Very coarse sand	1-2 mm
Coarse sand	0.5-1 mm
Medium sand	0.25-0.5 mm
Fine sand	0.1-0.25 mm
Very fine sand	0.05-0.1 mm
Silt	0.002-0.05 mm
Clay	< 0.002 mm

2. Chemical analysis shall include the following:

- a. pH and buffer pH.
- b. percentage of organic content by oven-dried weight.
- c. Nutrient levels by parts per million, including phosphorus, potassium, magnesium, manganese, iron, zinc, and calcium. Nutrient test shall include testing laboratory recommendations for supplemental additions to the soil, if necessary, based on the requirements for ornamental horticultural plants. Recommendations shall include rates at which additives are to be applied.
- d. Soluble salt by electrical conductivity of a 1:2 soil/water sample.

1.7 Delivery, Storage, and Handling

A. Digging Sod:

1. Sod shall not be dug at the nursery or approved source until ready to transport sod to the site of the work or acceptable storage location.
2. Before stripping, sod shall be mowed at a uniform height of 2 in.
3. Cut sod to specified thickness and to standard width and length desired.

B. Transportation of Sod:

1. Sod transported to the Project in open vehicles shall be covered with tarpaulins or other suitable covers securely fastened to the body of the vehicle to prevent injury. Closed vehicles shall be adequately ventilated to prevent overheating of the sod.
2. Evidence of inadequate protection following the digging, carelessness while in transit, or improper handling shall be cause for rejection.
3. Sod shall be kept moist, fresh, and protected at all times. Such protection shall encompass the entire period during which the sod is in transit, being handled, or are in temporary storage.
4. Upon arrival at the temporary storage location or the site of the work, sod material shall be inspected for proper shipping procedures. Should the sod be dried out, the Design Professional will reject the sod. When sod has been rejected, the Contractor shall immediately remove it from the area of the work and replace it with acceptable material.
5. Unless otherwise authorized by the Design Professional, the Contractor shall notify the Design Professional at least two working days in advance of the anticipated delivery date of sod material. Certificate of Inspection when required shall accompany each shipment.

C. Handling and Storage of Sod:

1. Sod material shall be handled with extreme care to avoid breaking or tearing strips.
2. Sod shall not be stored for longer than 30 hours prior to installation. Sod shall be stored in a compact group and shall be kept moist. Sod shall be prevented from freezing.
3. Sod that has been damaged by poor handling or improper storage will be rejected by the Design Professional.

D. Deliver seed in original sealed containers, labeled with analysis of seed mixture, percentage of pure seed, year of production, net weight, date of packaging, location of packaging, and name of seed grower. Damaged packages will not be accepted.

E. Seed shall be stored under cool and dry conditions so that the endophytic seed in the mixture is capable of maintaining a high level of endophytes.

F. Deliver fertilizer in sealed waterproof bags, printed with manufacturer's name, weight, and guaranteed analysis.

1.8 Planting Season

A. Planting season shall be as follows:

Material: _____ Planting Season
Spring _____ Fall

Seeding: Cool Season	3/1 to 5/15	9/1 to 11/15
Seeding: Warm Season	3/31 to 8/31	
<u>Material:</u>		<u>Planting Season</u>
	<u>Spring</u>	<u>Fall</u>
Sodding: Warm Season	2/15/ to 12/15	

1. Dormant Bermuda Grass sod may be installed, however, Contractor shall assume full responsibility for all sod through establishment and acceptance. Owner will not pay for dormant sod until fully established during season.
- B. Planting shall only be performed when weather and soil conditions are suitable for planting the material specified in accordance with locally accepted practice.
- C. Planting season may be extended with the written permission of the Design Professional.

1.9 Warranty

- A. Warranty for a period of one year, following the Date of Substantial Completion of the Project, all grass / seed against any defects (including: death and unsatisfactory growth) as determined by the Owner's Representative. Defects resulting from neglect by the Owner, abuse or damage by others, or unusual phenomenon or incidents beyond the Contractor's control are expected. Should questions arise concerning the responsibility of replacement, the Owner's Representative will be available for arbitration provided the Owner and Contractor mutually desire.
- B. Remove and replace all lawn found to be dead or in unhealthy condition during warranty period as determined by Owner's Representative or Owner. Make replacements as soon as weather conditions permit.
- C. Replacements: Match adjacent specimens of same species. Replacements are subject to all requirements stated in the Contract Documents and are subject to inspection by the Owner's Representative prior to removal.
- D. Repair grades, lawn areas, paving and any other damage resulting from replacement planting operations, at no additional cost to the Owner.
- E. Inspect Project Site monthly during warranty period to determine what changes, if any, should be made in the maintenance program. Submit all recommended changes in writing to the Owner.
- F. Replacements made during the Warranty Period or following inspection for Final Acceptance will carry on additional one year warranty beginning at the time of replacement.

Part 2 Products

2.1 Sod

- A. Certified Turfgrass Sod: Superior sod grown from certified, high quality seed of known origin or from plantings of certified grass seedlings or stolons. It shall be inspected by the certification agency of the state in which it is grown to assure satisfactory genetic identity and purity, overall high quality and freedom from noxious weeds as well as excessive quantities of other crop and weedy plants at time of harvest. All seed or original plant material in mixture must be certified. Turfgrass sod shall meet the published state standards for certification.
1. Sod shall be Certified Bermudagrass as shown on the plans.
 2. Sports turf shall be sand based Certified Bermudagrass as shown on plans
- B. Sod shall be nursery grown on cultivated mineral agricultural soils. Sod shall have been mowed regularly and carefully, and otherwise maintained from planting to harvest.
- C. Type and Size of Sod:
1. Furnish either big roll or block sod. Ensure that big roll sod is a minimum of 21 in. wide x 52 ft. long. Minimum dimensions for block sod shall be 12 in. wide x 22 in. long. Ensure that all sod consists of uniform soil thickness of not less than 1 in.
- D. Strength of Sod Strips: Standard size sections of sod shall be strong enough to support their own weight and retain their size and shape if suspended vertically when grasped in the upper 10% of the section.
- E. Moisture Content: Sod shall not be harvested or transplanted when moisture content (excessively dry or wet) may adversely affect its survival.
- F. Time Limitations: Sod shall be harvested, delivered, and transplanted within a 36 hour period unless a suitable preservation method is approved prior to delivery. Sod not transplanted within this period shall be inspected and approved by the Design Professional prior to its installation.
- G. Thatch: Sod shall be relatively free of thatch. A maximum of 1/2 in. (uncompressed) thatch will be permitted.
- H. Diseases, Nematodes, and Insects: Sod shall be free of diseases, nematodes, and soil-borne insects. State Nursery and Plant Materials Laws require that all sod be inspected and approved for sale. The inspection and approval must be made by the State Agricultural Department, Office of the State Entomologist.

- I. Weeds: Sod shall be free of objectionable grassy and broad leaf weeds. Turfgrass sod shall be considered free of such weeds if less than five such plants are found per 100 sq. ft. of area.
 - 1. Turfgrass sod shall not be acceptable if it contains any of the following weeds: common bermudagrass (wiregrass), quackgrass, johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel and bromegrass.

2.2 Sod Farm Growing Medium

- A. Soil in which sod was grown shall be classified as loam or sandy loam (silt loam is not acceptable) and shall conform to the following grain size distribution for material passing the #10 sieve:

B. S. Sieve No.	% Passing by Weight	Minimum	Maximum
	10	100	---
	20	75	100
	40	30	85
	100	12	45
	270	5	25
	0.002 mm	1	4

- 1. The maximum retained on the #10 sieve shall be 15% by weight of the total sample.
- 2. Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422.
- 3. The organic content shall be between 3.0 and 8.0 percent.

2.3 Planting Soil

- A. See section 32 91 13.19 Planting Soils

2.4 Compost

- A. Compost shall be derived from organic wastes such as food and agricultural residues, animal manures, mixed solid waste and biosolids (treated sewage sludge) that meet all State Environmental Agency requirements. The product shall be well composted, free of viable weed seeds and contain material of a generally humus nature capable of sustaining growth of vegetation, with no materials toxic to plant growth.
 - 1. Compost shall have the following properties:

<u>Parameters</u>	<u>Range</u>
pH	5.5 – 8.0
Moisture Content	35% - 55%

Soluble Salts	≤ 4.0 mmhos (dS)
C:N ratio	15 – 30:1
<u>Parameters</u>	<u>Range</u>
Particle Size	< 1"
Organic Matter Content	> 50%
Bulk Density	< 1000 lbs./cubic yard
Foreign Matter	< 1% (dry weight)

2. Compost generator shall also provide minimum available nitrogen and other macro and micronutrients to determine fertilizer requirements.
3. Guidelines for quantity of compost required to achieve suitable soil organic content in soil mixes for ornamental horticultural planting shall be as recommended by the compost manufacturer.
4. Organic matter shall be commercially prepared compost and meet US Composting Council STA/TMECC criteria or equal for Class I or II stable mature product. Compost made from primarily green yard waste shall not be acceptable.

2.5 Limestone

- A. Ground limestone shall be an agricultural limestone containing a minimum of 85% total carbonates, by weight. Ground limestone shall be graded within the following limits:

<u>Sieve Size</u>	<u>% Passing by Weight</u>
No. 10	100
No. 20	90
No. 100	60

2.6 Water

- A. Water shall be suitable for irrigation and free from ingredients harmful to seeded or sodded areas.

2.7 Commercial Fertilizer

- A. Starter fertilizer shall be HD Scotts Starter Fertilizer or approved equal.
- B. Fertilizer shall conform to the following:
 1. When applied as a topsoil amendment, fertilizer shall have an analysis that will deliver appropriate amounts of nitrogen, phosphorus, and potassium as required to remedy deficiencies revealed by testing the topsoil.
 - a. 50% of nitrogen shall be derived from natural organic source of ureaform.

- b. Available phosphorus shall be derived from superphosphate, bone meal, or tannage.
 - c. Potassium shall be derived from muriate of potash containing 60% potash.
- C. Fertilizer shall be delivered in manufacturer's standard container printed with manufacturer's name, material weight, and guaranteed analysis.
- D. Fertilizers with N-P-K analysis other than that stated above may be used provided that the application rate per square foot of nitrogen, phosphorus, and potassium is equal to that specified.

2.8 Superphosphate

- A. Superphosphate shall be composed of finely ground phosphate rock as commonly used for agricultural purposes and containing not less than 20% available phosphoric acid. The superphosphate shall be delivered to the site in the original unopened containers, each bearing the manufacturer's guaranteed analysis. Any superphosphate which becomes caked or otherwise damaged making it unsuitable for use, will be rejected.

2.9 Weed Control

- A. Weed control for stockpiled topsoil shall be a non-selective weed killer for control of grassy and broadleaf weeds; weed control shall have short residual, allowing seeding and sodding operations to occur within 7 days of application.

Part 3 Execution

3.1 Preparation of Subgrade

- A. Subgrade shall be examined to ensure that rough grading and all other subsurface work in lawn areas and other areas to be seeded or sodded is done prior to start of seeding.
- B. The area to be sodded or seeded shall be stripped of any excess organic material or grass prior to installation. Topsoil remaining after organic material removal shall be removed, cleaned and stockpiled for later use. Remove small loose rocks, stone and debris of 1/2" or larger with a Harley Rock Machine or equivalent as required leaving the grade reasonably free of such miscellaneous matter.
- C. Existing subgrade shall be loosened or scarified to a minimum depth of 3 in. prior to spreading topsoil. Subgrade shall be brought to true and uniform grade and shall be cleared of stones greater than 2 in., sticks, and other extraneous material.

3.2 Spreading of Planting Soil

- A. Planting soil shall be spread and placed to required depths, as indicated on the drawings.
- B. Surfaces shall be graded and smoothed, eliminating all sharp breaks by rounding, scraping off bumps and ridges, and filling in holes and cuts.
- C. Prior to installing any planting soil mix, the Design Professional will approve the condition of the subgrade.
- D. In areas of soil installation, till the planting soil mix into the top layer of subgrade.
 - 1. Scarify or till the surface of subgrade to a depth of 2 – 3 in. with a backhoe or other suitable device.
 - 2. Spread a layer of the specified planting soil mix 2 – 3 in. deep over subgrade.
 - 3. Thoroughly till the planting soil mix and the subgrade together.
 - 4. Immediately install the remaining planting soil mix in accordance with the following specifications. Protect the tilled area from traffic. Do not allow tilled subgrade to become overly compacted.
 - 5. In the event that the tilled area becomes overly compacted, till the area again prior to installing the planting soil mix.
- E. Install the remaining planting soil mix in 8 – 10 in. lifts to the required depths.
- F. The depths and grades indicated on the Drawings are the final grades after settlement and shrinkage of the organic material. Contractor shall install the planting soil mix at a higher level to compensate for this anticipated reduction of planting soil volume depending upon the predicted settling properties of each planting soil mix type.

3.3 Planting Soil Compaction

- A. Compact each 8 – 10 in. lift with mechanical compaction equipment to the compaction rates indicated.
 - 1. Achieve a soil density of between 1.45 to 1.55 grams per cubic centimeter over dry weight divided by volume (80 to 85% of the standard proctor maximum dry density.)
 - 2. Planting mix compaction shall be tested at each lift using a cone penetrometer calibrated to the mockup soil and its moisture level. The same penetrometer and moisture meter used for the testing of the mockup shall be used to test installed soil throughout the work.

3. Maintain at the site a hand penetrometer with pressure dial and a soil moisture meter to measure the compaction rates relative to the mockup soil compaction.
- B. Maintain moisture conditions within the planting mixes during installation to allow for satisfactory compaction. Suspend installation operations if the planting mix becomes wet. Do not place planting mixes on wet or frozen subgrade.
- C. Provide adequate equipment to achieve consistent and uniform compaction of the planting mixes. Use the smallest equipment that can reasonably perform the task of spreading and compaction.
 1. Testing shall be performed by the Contractor.
 2. Record the test results on a soil compaction log. This report shall include the location of the test. The depth of the test measures from the proposed finish grade, the penetrometer reading and the moisture meter reading.
 3. Submit the compaction log at the end of the soil installation period. Soil compaction log shall be kept current and available at the site for review at all times.

3.4 Application Of Fertilizer and Conditioners

- A. Do not apply nitrogen between October 15 and March 15.
- B. Fertilizer and conditioners shall be applied at the following rates:
 1. Compost - as required by test results of topsoil.
 2. Limestone - as required by test results of topsoil.
 3. Fertilizer - as required by test results of topsoil.
- C. Mixing with planting soil:
 1. Fertilizer and conditioners shall be spread over the entire lawn areas at the application rates indicated above.
 2. Materials shall be uniformly and thoroughly mixed into the top 4 in. of planting soil by disking, rototilling, or other approved method.

3.5 Finish Grading

- A. Planting soil shall not be fine graded until it is possible to follow immediately or within 24 hours with seeding or sodding operations. If topsoil is spread prior to this time it shall be cultivated to loosen soil prior to seeding or sodding.
- B. Planting soil shall not be placed when subgrade or topsoil material are frozen, excessively wet, or excessively dry.

- C. Contractor shall set grade lines for Design Professional's review and approval.
 - 1. Final surface of topsoil immediately before seeding and sodding shall be within + 1/2 in. of required elevation, with no ruts, mounds, ridges, or other faults, and no pockets or low spots in which water can collect. Stones, roots, and other debris greater than 1 in. in any dimension, which are visible at the surface, shall be removed and the resulting holes filled with topsoil, leaving a uniform planar surface.
- D. Finish grade surface with a drag or rake. Round out all breaks in grade, smooth down all lumps and ridges, fill in all holes and crevices. Rolling with a light roller is acceptable, if the surface is scarified afterward.
- E. In the event of settlement, the Contractor shall readjust the work to required finished grade.
- F. Allow for sod thickness in areas to be sodded.
- G. Remove small loose rocks, stone and debris of 1/2" or larger with a Harley Rock Machine or equivalent as required leaving the grade reasonably free of such miscellaneous matter. Remove all debris legally from the Site.

3.6 Seed Application

- A. Seed shall be applied in two applications; by mechanical spreader.
- B. First Application: Seed shall be broadcast by means of an approved mechanical spreader, to give a uniform application at the following rates: Refer to Article 2.1 Seed.
 - 1. Seed shall be applied in two equal applications for uniform coverage; direction of travel of spreader for second pass shall be perpendicular to that of the first pass. Seeding shall not be done when it is raining or snowing, or when wind velocity exceeds 5 mph.
 - 2. Following seeding the area shall be lightly raked to mingle seed with top 1/8 to 1/4 in. of soil. Area shall then be fine graded. Stones and other debris greater than 1 in. in any dimension which are visible on surface shall be removed.
- C. Following seeding and raking, entire area shall be rolled with a hand roller having a weight of 60 to 90 lb./ft. of width, and a minimum diameter of 2 ft. Entire area shall then be watered by use of lawn sprinklers, or other approved means. Initial watering shall continue until the equivalent of a 2 in. depth of water has been applied to entire seeded surface, at a rate which will not dislodge the seed. Watering shall be repeated thereafter as frequently as required to prevent drying of the surface, until the grass attains an average height of 1/4 in. Watering methods and apparatus which may cause erosion of the surface shall not be permitted.

- D. Evenly apply wheat straw 2 in. thick over all seeded areas. (Approximately 60 bales per acre). The Contractor under any circumstances, use local hay as it will most likely be Johnson Grass (*Sorghum Halepense*).
- E. Apply asphalt emulsion binder to mulch at rate to effectively hold mulch in place. Immediately replace mulch that blows away.
- F. Rope off entire seeded area to prevent vehicles and pedestrians from entering area.

3.7 Sodding

- A. Edges of the sodded areas shall be smooth, and all sodded areas shall conform to the design cross sections and grade. At edges adjacent to curbs, paved areas, etc., top surface of earth in sod shall be 1/2 in. below adjacent hard surface.
- B. Sod shall be placed, and all sodding operations completed within 72 hours following stripping from sod source bed.
- C. On slopes steeper than 2 to 1, sod shall be fastened in place with suitable wood pins or other approved methods, spaced at not less than 1 pin per square foot.
- D. Surface of completed sodded area shall be smooth. Sod shall be laid edge-to-edge, with tight-butted, staggered joints. Sod shall be carefully placed to ensure that it is neither stretched or overlapped. Immediately after laying sod shall be pressed firmly into contact with sod bed by tamping or rolling, to eliminate air pockets. Following compaction, topsoil shall be used to fill all cracks, and excess soil shall be worked into grass with rakes or other suitable equipment. Sod shall not be smothered with excess fill soil.
- E. Immediately after sodding operations have been completed, entire surface shall be compacted with a cultipacker roller or other approved equipment weighing 100 to 160 lb./ft. of roller.
- F. Lay sod to form a solid mass with tightly fitted joints. Snugly fit ends and sides of sod strips; do not overlap. Stagger strips to offset joints in adjacent courses. Work from boards to avoid damage to subgrade or sod. Tamp or roll lightly to ensure contact with subgrade. Work sifted soil into minor cracks between pieces of sod; remove excess to avoid smothering of adjacent grass.
- G. Lay sod if from rolls as specified. Monofilament mesh is to be removed from the sod as it is placed. Lay sod to form a solid mass with tightly fitted joints. Trim ends of rolls as necessary to provide square joints and snugly fit ends and sides. Tamp or roll lightly to ensure contact with subgrade. Work sifted sand into minor cracks between pieces of sod; remove excess to avoid smothering of adjacent grass.
- H. Anchor sod with sod staples to prevent slippage on slopes equal to or greater than 3:1 and wherever erosion can be anticipated. Lay sod perpendicular to slope direction, with staggered joints.

- I. Immediately after sod installation, water thoroughly with a fine spray until the soil is damp to a depth of 4". The watering shall be the responsibility of the Contractor during the installation and maintenance period. The sod shall be kept moist until rooting occurs and then irrigate as needed a healthy and vigorous stand of grass.
- J. Roll the surface after "rooting in" has occurred.

3.8 Hydroseeding

- A. Hydroseeding may be used on any grassing area. Under this method, spread the seed, fertilizer, and wood fiber mulch in the form of a slurry. Seeds of all sizes may be mixed together.
- B. Apply hydroseeding as follows:
 - 1. Use wood fiber mulch as a metering agent and seed bed regardless of which mulching method is chosen. Apply wood fiber mulch at approximately 1000-1500 lbs./acre.
 - 2. Prepare the ground for hydroseeding as specified for conventional seeding. Starter fertilizer may be added to the surface of the seed bed. Verify that all areas to receive the hydroseed mixture are free of vegetation and other objectionable materials. Verify that grades are within final specified standards and that the area is uniformly compacted.
 - 3. Use specially designed equipment to mix and apply the slurry uniformly over the entire seeding area.
 - 4. Agitate the slurry mixture during application.
 - 5. Discharge slurry within one hour after being combined in the hydroseeder. Do not hydroseed when winds prevent an even application.
 - 6. Closely follow the equipment manufacturer's directions unless the Engineer modifies the application methods.
 - 7. Mulch the entire hydroseeded area.
 - 8. Take precautions against overspray onto adjacent roads, curbs, sidewalks, buildings, and other surfaces except the ground areas scheduled to receive the seed. Contractor shall promptly clean all areas of overspray to the satisfaction of the Owner and Design Professional.

3.9 Fertilizer

- A. After sod is installed, apply liquid fertilizer for grow-in purposes. Alternate applications of 32-0-0 and 12-4-12 at a rate of 8 ½ gallons of each product per acre per week for a three-week period, with three to four days between applications of 32-0-0 and 12-4-12.

- B. Fertilizers shall be applied only during the growing season when Bermuda is completely out of dormancy. If fertilizer brand type recommends a different rate, the Contractor shall advise the Owner's Representative of the rate recommended prior to applying any fertilizer to clarify the proper rate of use.
- C. 32-0-0 liquid fertilizer to be comprised of 7.89% ammoniacal nitrogen, 7.89% nitrate nitrogen and 16.22% urea nitrogen.
- D. 12-4-12 liquid fertilizer to be comprised of 12% total nitrogen (N), 4% available phosphate (P₂O₅) and 12% soluble potash (K₂O).

3.10 Maintenance

- A. Begin maintenance immediately after installation.
- B. Maintain sod until Date of Substantial Completion of the Project in total.
- C. Maintain lawns by watering, weeding, fertilizing, weekly mowing, repair of eroded areas and re-seeding or re-sodding as necessary to establish a uniform stand of the specified grasses. Contractor shall perform "Grow-In" activity (weed control, fertilizing, watering & mowing) throughout the contract period and at a minimum, shall include 6 weeks of "Grow-In" activity and monitoring, after initial laying of sod. Grow-in activity per turf manufacturer recommendations. Provide written Grow-in and normal maintenance instructions to the Owner. Grow in activity shall continue until final acceptance by the Owner.

3.11 Clean Up and Protection

- A. During Work, keep pavements clean and work area in an orderly condition.
- B. Upon completion of Work, clear grounds of debris, superfluous materials, and all equipment. Remove from Site to satisfaction of Owner.
- C. Protect Sod from damage due to landscape operations, operations by other contractors and trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged Work as directed by Owner's Representative, at no additional cost to the Owner.

END OF SECTION

Part 1 General

1.1 Summary

- A. Provide all materials and equipment, and do all work required to complete the planting soils and planting as indicated on the Drawings and as specified.

1.2 Related Work

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
 - 1. Section 01 40 00, Quality Requirements; Procedural requirements for quality assurance and quality control.
 - 2. Section 31 20 00, Earth Moving.
 - 3. Section 32 84 00, Irrigation System.
 - 4. Section 32 90 01, Sports field Construction
 - 5. Section 32 92 00, Lawns and Grasses.
 - 6. Section 32 91 13.19, Planting Soils

1.3 References

- A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. American National Standards Institute, Inc. (ANSI):
 - a. 1 American Standard for Nursery Stock (Sponsor: American Association of Nurserymen, Inc.)
 - b. A300 American National Standards for Tree Care Operations
 - 2. American Society for Testing and Materials (ASTM):
 - a. F 405 Corrugated Polyethylene (Pe) Tubing and Fittings
 - 3. "Hortus Third", A Concise Dictionary of Plants Cultivated in the United States and Canada, Cornell University, L.H. Bailey Hortorium, MacMillian Publishing Co., New York, NY.
 - 4. International Society of Arboriculture (ISA)

1.4 Submittals

- A. Samples: The following samples shall be submitted:

<u>Material</u>	<u>Sample Size or Quantity</u>
Mulch	1 ft. ³
Compost	1 ft. ³
Soil separator	1 ft. ³
Topsoil	1 ft. ³
Planting soil (each type)	1 ft. ³
Tree stake	24 in. length
Tree anchoring system	1 fitting

- B. Manufacturer's Product Data: Manufacturer's product data shall be submitted for the following materials:

1. Aluminum sulfate
2. Antidesiccant
3. Fertilizer
4. Fungicide
5. Herbicide
6. Insecticide
7. Compost

- C. Certificates: Labels from the manufacturer certifying that the product meets the specified requirements shall be submitted for the following materials:

1. Commercial fertilizer
2. Limestone
3. Compost

- D. Test Reports: Test reports from an approved testing agency indicating compliance with the specifications shall be submitted for on-site soil, planting soil, topsoil, and any other materials designated by the Design Professional.

- E. Planting Schedule: Submit planting schedule showing scheduled dates for each type of planting in each area of site, prior to beginning of the Work.

- F. Maintenance Instructions: Upon completion of the installation, submit typewritten recommendations for maintenance of any portion of the landscape which, in the opinion of the Contractor, requires special attention.

1.5 Owner's Inspection and Testing

- A. Work will, at all times, be subject to inspection by the Design Professional. The Owner reserves the right to engage an independent testing laboratory to analyze and test materials used in the construction of the work. Where directed by the Design Professional, the testing laboratory will make material analyses and will report to the Design Professional whether materials conform to the requirements of this specification.
1. Cost of tests and material analyses made by the testing laboratory will be borne by the Owner when they indicate compliance with the specification, and by the Contractor when they indicate non-compliance.
 2. Testing equipment will be provided by, and tests performed by the testing laboratory.

1.6 Contractor's Inspection and Testing

- A. Contractor shall submit soil test analysis report for each sample of planting soil, existing or other, and each specified planting soil type mix.
- B. The Contractor shall engage an independent testing agency, experienced in the testing of agricultural soils and acceptable to the Design Professional, to perform the topsoil/planting soil tests and analyses specified herein. All costs associated with testing shall be the Contractor's responsibility.
1. Particle size analysis shall include the following gradient of mineral content:

<u>USDA Designation</u>	<u>Size in mm</u>
Gravel	+ 2 mm Very coarse sand 1-2 mm Coarse sand 0.5-1 mm Medium sand 0.25-0.5 mm Fine sand 0.1-0.25 mm Very fine sand 0.05-0.1 mm
Silt	0.002-0.05 mm
Clay	< 0.002 mm
 2. Chemical analysis shall include the following:
 - a. pH and buffer pH
 - b. percentage of organic content by oven-dried weight
 - c. Nutrient levels by parts per million, including phosphorus, potassium, magnesium, manganese, iron, zinc, and calcium. Nutrient test shall include testing laboratory recommendations for supplemental additions to the soil, if necessary, based on the requirements for ornamental

horticultural plants. Recommendations shall include rates at which additives are to be applied.

- d. Soluble salt by electrical conductivity of a 1:2 soil/water sample.

1.7 Source Quality Control

A. Reference Standards

1. Standardized Plant Names, latest edition, by the American Joint Committee on Horticultural Nomenclature.
2. American Standard for Nursery Stock, ANSI Z601, latest edition, by the American Association of Nurserymen.

B. Selection of Plant Materials: Submit to the Design Professional the names and locations of nurseries proposed as sources of acceptable plant material. Inspect all nursery materials to determine that the materials meet the requirements of this section. Proposed materials shall be flagged at the nurseries by the Contractor prior to viewing by the Design Professional.

1. Schedule with the Design Professional a time for viewing plant material at the nursery. Trips to nurseries shall be efficiently arranged to allow Design Professional to maximize viewing time. A minimum of six weeks shall be allowed for this viewing prior to time that plants are to be dug.
2. Design Professional may choose to attach seal to each plant, or representative samples. Where requested by the Design Professional, photographs of plant material or representative samples of plants shall be submitted.
3. Viewing and/or sealing of plant materials by the Design Professional at the nursery, in photograph, or representative sample does not preclude the Design Professional's right to reject material at the site of planting.
4. In the event plant material is found to be unacceptable, the Contractor will pursue other sources until acceptable plant material is found, at no additional cost to the Owner. If, due to unacceptable plant material at the Contractor's source, additional tagging trips are required by the Landscape Architect, the Contractor will reimburse the Landscape Architect for time (\$1,000.00/day) plus travel expenses.

1.8 Plant Material Quantities

- A. In the event of a discrepancy in plant material quantities between the Drawings and the Plant List(s), the Drawing quantity shall be required.
- B. Contractor is responsible for the verification of plant quantities. In the event of a discrepancy, the contractor shall notify the Landscape Architect of said discrepancy.

1.9 Availability of Plant Material

- A. Contractor is not to make substitutions. If specified landscape material is not obtainable, submit to Landscape Architect proof of non-availability and a proposal for use of equivalent material. Contractor must submit proof of non-availability, in the form of a written statement, from a minimum of 12 reliable Nursery Sources (American Nurserymen's Association Members) that the plant in question is not obtainable in the Eastern United States.

1.10 Delivery, Storage, And Handling

- A. Digging Plant Material: Plants shall not be dug at the nursery or approved source until the Contractor is ready to transport them from their original locations to the site of the work or acceptable storage location.
- B. Transportation of Plant Material: Ship landscape material with certificates of inspection required by governing authorities. Inspection by Federal and/or State Governments at Grower does not preclude rejection of plants at the site by Landscape Architect. Comply with regulations applicable to landscape materials. Prepare plants for shipment to prevent damage to plants.
 - 1. Plants transported to the project in open vehicles shall be covered with tarpaulins or other suitable covers securely fastened to the body of the vehicle to prevent injury to the plants. Closed vehicles shall be adequately ventilated to prevent overheating of the plants. Plants shall not remain in darkened enclosed trailer for more than 48 hours cumulative.
 - 2. From March 15th to September 15, ship plant material to be transported over 100 miles at night only.
 - 3. Plants shall be kept moist, fresh, and protected at all times. Such protection shall encompass the entire period during which the plants are in transit, being handled, or are in temporary storage.
 - 4. Do not ship plant materials in temperatures below 20 degrees Fahrenheit.
 - 5. Unless otherwise authorized by the Design Professional, notify the Design Professional at least three working days in advance of the anticipated delivery date of any plant material. A legible copy of the bill of lading, showing the quantities, kinds, and sizes of materials included for each shipment shall be furnished to the Design Professional.
- C. Storage: Unless specific authorization is obtained from the Design Professional, plants shall not remain on the site of work longer than three days prior to being planted.
 - 1. Plants that are not planted immediately shall be protected as follows:

- a. Earth balls shall be kept appropriately moist, and their solidity carefully preserved.
 - b. Plants shall not be allowed to dry out or freeze.
 - c. Do not store plant material on asphalt or concrete surface.
 - d. If planting is delayed more than 24 hours the Contractor shall provide temporary irrigation system to keep plant material roots moist.
2. Both the duration and method of storage of plant materials shall be subject to the approval of the Design Professional.
- D. Handling of Plant Materials: Exercise care in handling plant materials to avoid damage or stress.
1. Do not remove container grown stock from containers until planting time.
 2. Do not prune prior to delivery.
 3. Do not bend or bind-tie trees or shrubs in such a manner as to damage bark, break branches or destroy natural shape.
- E. Label at least one tree and one shrub of each variety with a securely attached waterproof tag bearing legible designation of botanical and common name. Do not remove any label that has been attached to plant material until directed by the Landscape Architect to do so.
- F. Analysis and Standards: Package standard products with manufacturer's certified analysis. For the materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists wherever applicable.
- G. Topsoil: See Section 32 91 13.19 for Topsoil requirements.
- H. Soil Report: Contractor shall engage a reputable laboratory to include testing and analysis of soils representative of planting areas and lawn areas on site, and new topsoil to be used on site and within soil mix, with reference to specified plant materials as necessary. Report shall list fertilization and soil amendment recommendations to ensure vigorous growth of all plants specified. Soil report to include analysis of a minimum of three soil samples from different locations on site.

1.11 Rejection Of Materials

- A. Evidence of inadequate protection following digging, carelessness while in transit, or improper handling or storage, shall be cause for rejection.
- B. Upon arrival at the temporary storage location or the site of the work, plants shall be inspected for proper shipping procedures. Should the roots be dried out, large

branches be broken, balls of earth broken or loosened, or areas of bark be torn, the Design Professional will reject the injured plant.

- C. When a plant has been rejected, remove it from the area of the work within 3 days and replace it with one of the required specifications.
- D. Approval and Selection of Materials and Work: the selection of all materials and the execution of all operations required under the Drawings and Specification is subject to the approval of the Landscape Architect and the Owner. They have the right to reject any and all materials and / or work which, in their opinion, does not meet the requirements of the Contract Documents at any stage of the operations. The Contractor shall remove rejected work and/ or materials from the Project site and replace promptly.

1.12 Planting Season

- A. Planting: Planting may commence as soon as the ground has thawed at the nursery and at the site of planting, and weather conditions make it practicable to work both at the nursery and at the site.
 - 1. Planting shall occur within the following seasonal limitations:

<u>Material</u>	<u>Planting Period</u>
Deciduous Trees and Shrubs	Between October 15 and May 15
Evergreen Trees and Shrubs	Between October 15 and May 15
- B. Regardless of the dates specified above, planting shall only be performed when weather and soil conditions are suitable for planting the material specified in accordance with locally accepted practice.
- C. Planting season may be modified only with the written permission of the Design Professional. Plant material guarantee shall be honored regardless of extended planting season.

1.13 Acceptance

- A. Acceptance of plant material by the Design Professional will be for general conformance to specified size, character, and quality, and shall not diminish responsibility for full conformance to the Contract Documents.
- B. Acceptance in Part
 - 1. The work may be accepted in parts when it is deemed to be in the Owner's best interest to do so, and when permission is given to the Contractor in writing to complete the work in parts.
 - 2. Acceptance and use of such areas by the Owner shall not waive any other provisions of this Contract.

1.14 Maintenance

- A. Contractor is responsible for watering and maintaining all newly installed plant materials, as needed, until substantial completion
- B. Remove and replace all trees, shrubs, groundcovers and lawn, or other plants found to be dead or in unhealthy condition during warranty period as determined by Landscape Architect or Owner. Make replacements as soon as weather conditions permit.
- C. Replacements: Match adjacent specimens of same species. Replacements are subject to all requirements stated in the Contract Documents and are subject to inspection by the Landscape Architect prior to digging.
- D. Repair grades, lawn areas, paving and any other damage resulting from replacement planting operations, at no additional cost to the Owner.
- E. Inspect Project Site monthly during warranty period to determine what changes, if any, should be made in the maintenance program. Submit all recommended changes in writing to the Landscape Architect and the Owner.
- F. Replacements made during the Warranty Period or following inspection for Final Acceptance will carry on additional one-year warranty beginning at the time of replacement.

1.15 Warranty

- A. Warranty for a period of one year, following the Date of Substantial Completion, all trees, shrubs, groundcovers, and grass against any defects (including: death and unsatisfactory growth) as determined by the Owner's Representative. Defects resulting from neglect by the Owner, abuse or damage by others, or unusual phenomenon or incidents beyond the Contractor's control are excepted. Should questions arise concerning the responsibility of replacement, the Landscape Architect will be available for arbitration provided the Owner and Contractor mutually desire.

1.16 Quality Assurance

- A. Installer Qualifications: Landscape Contractor shall have successfully completed five (5) projects similar in material, size, scope and complexity to that indicated for this Project that have resulted in construction with a record of successful in-service performance.
 - 1. Firm Experience Period: Five (5) years of experience
 - 2. Field Foreman Experience: Five (5) years of experience with installing firm.
- B. Conference: Before any work is started a conference shall be held between the Contractor and the Owner concerning the work under this contract.

- C. The Contractor shall maintain continuously a competent superintendent, satisfactory to the Owner, on the work during progress with authority to act for him in all matters pertaining to the work.
- D. It is the Landscape Contractor's responsibility to coordinate and cooperate with the other Contractors to enable work to proceed rapidly and efficiently.
- E. The Landscape Contractor shall confine his operations to the area to be improved and to the areas allotted him by the Designer and General Contractor for material and equipment.
- F. Landscape Contractor shall take all necessary steps to protect the existing site conditions and vegetation.

Part 2 Products

2.1 Plants

- A. Except as otherwise specified, size and grade of plant materials shall conform to ANSI Z60.1. In no case shall ball size be less than 11 in. in diameter for each inch of caliper.
- B. Plants shall have outstanding form; symmetrical, heavily branched with an even branch distribution, densely foliated and/or budded, and a strong, straight, distinct leader where this is characteristic of species. Plants shall possess a normal balance between height and spread. The Design Professional will be the final arbiter of acceptability of plant form.
- C. Plants shall be healthy and vigorous, free of disease, insect pests and their eggs, and larvae.
- D. Plants shall have a well-developed fibrous root system.
- E. Plants shall be free of physical damage such as scrapes, broken or split branches, scars, bark abrasions, sunscalds, fresh limb cuts, disfiguring knots, or other defects. These defects shall not interrupt more than 25% of the circumference of the plant cambium.
- F. Plants shall meet the sizes indicated on the Plant List. Plants larger or smaller than specified may be used only if accepted by the Design Professional. Use of larger plants shall not reduce the required plant quantity, increase the Contract price or allow the supplier to use smaller than specified material for other plants. If larger plants are approved, the root ball, spread, and container size shall be increased proportionately to the size of the plant.
- G. Where a size or caliper range is stated, at least 50% of the material shall be closer in size to the top of the range stated.
 - 1. Determining dimensions for trees shall be caliper, height, and spread.

- a. Caliper shall be measured 6 in. above ground for trees up to and including 4 in. caliper.
 - b. Trees over 4 in. caliper shall be measured 12 in. above ground.
 - c. Specified height and spread dimensions refer to the main body of the plant and not branch tip to tip. Take measurements with branches in natural position.
- H. Plants shall not be pruned before delivery.
- I. All trees and shrubs shall be labeled. Labels shall be durable and legible, stating the correct plant name and size in weather-resistant ink or embossed process. Labels shall be securely attached to all plants prior to delivery to the site, being careful not to restrict growth.
- J. Plants indicated as "B&B" shall be balled and burlapped. Ball shall be firmly wrapped in biodegradable burlap and securely tied with biodegradable heavy twine, rope or wire baskets. Plants with loose, broken or manufactured root balls will be rejected. Root balls shall be lifted from the bottom only, never by stems or trunks.
- K. Container grown plants shall be well rooted and established in the container in which they are growing.
1. All plant materials, shipments and deliveries shall comply with state and federal laws and regulations governing the inspection, shipping, selling and handling of plant stock. A certificate of inspection, or a copy thereof, for injurious insects, plant diseases and other plant pests shall accompany each shipment or delivery of plant material. The certificate shall bear the name and address of the source of the plant stock.
- L. Vines and ground covers: Provide healthy, field-grown plants from a commercial nursery, of species and variety shown or listed.

2.2 Perennial Plants

- A. Perennial Plants: Provide perennial plants of species indicated, established and well rooted in pots or similar containers, and complying with ANSI Z60.1.

2.3 Planting Soil

- A. See Section 32 91 13.19 Planting Soils

2.4 Compost

- A. Compost shall be derived from organic wastes such as food and agricultural residues, animal manures, mixed solid waste and biosolids (treated sewage sludge) that meet all State Environmental Agency requirements. The product shall be well composted, free of viable weed seeds and contain material of a generally humus

nature capable of sustaining growth of vegetation, with no materials toxic to plant growth.

1. Compost shall have the following properties:

<u>Parameters</u>	<u>Range</u>
pH	5.5 – 7.5
Moisture Content	35% - 55%
Soluble Salts	≤ 4.0 mmhos (dS)
C:N ratio	15 – 30:1
Particle Size	< 1"
Organic Matter Content	> 50%
Bulk Density	< 1000 lbs./cubic yard
Foreign Matter	< 1% (dry weight)

2. Compost generator shall also provide minimum available nitrogen and other macro and micronutrients to determine fertilizer requirements.
3. Guidelines for quantity of compost required to achieve suitable soil organic content in soil mixes for ornamental horticultural planting shall be as recommended by the compost manufacturer.
4. Organic matter shall be commercially prepared compost and meet US Composting Council STA/TMECC criteria or equal for Class I or II stable mature product. Compost made from primarily green yard waste shall not be acceptable.

2.5 Limestone

- A. Limestone shall be an approved agricultural limestone containing no less than 50% of total carbonates, and 25% total magnesium with a neutralizing value of at least 100%. The material shall be ground to such a fineness that 40% will pass through a No. 100 U.S. Standard Sieve, and 98% will pass through a No. 20 U.S. Standard Sieve. The lime shall be uniform in composition, dry and free flowing, and shall be delivered to the site in the original unopened containers, each bearing the manufacturer's guaranteed analysis. Any lime which becomes caked or otherwise damaged making it unsuitable for use, will be rejected.

2.6 Aluminum Sulfate

- A. Aluminum sulfate shall be unadulterated and shall be delivered in containers with the name of the material and manufacturer and net weight of contents.

2.7 Water

- A. Water shall be suitable for irrigation and shall be free from ingredients harmful to plant life.

2.8 Fertilizer

- A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - 1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency. Manufacturer's literature shall be submitted for approval.
- B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water- insoluble nitrogen, phosphorus, and potassium in the following composition:
 - 1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

2.9 Superphosphate

- A. Superphosphate shall be composed of finely ground phosphate rock as commonly used for agricultural purposes and containing not less than 20% available phosphoric acid. The superphosphate shall be delivered to the site in the original unopened containers, each bearing the manufacturer's guaranteed analysis. Any superphosphate which becomes caked or otherwise damaged making it unsuitable for use, will be rejected.

2.10 Mulch

- A. Mulch shall be pine straw or a 100% fine-shredded pine bark mulch, of uniform size and free from rot, leaves, twigs, debris, stones, or any material harmful to plant growth.
 - 1. Mulch shall have been shredded and stockpiled no less than six months and no more than two years before use.
 - 2. No chunks 3 in. or more in size, and thicker than 1/4 in. shall be left on site.
 - 3. Shredded mulch shall be of sufficient size and character as to not be easily displaced by wind or water erosion.

2.11 Guying and Staking Materials

- A. Metal T- Bar Posts 6 ft. long (2 per tree). Stakes shall be primed and painted black or dark green. Wire for staking shall be 12 gauge steel or plastic tree chain.
- B. Strapping: A safe, soft, elastic type strapping material specifically designed to replace traditional wire and hose, with an expanding design as the tree grows in caliper, preventing girdling.

- C. Guying System: Tree support system shall be as depicted on tree staking details.
 - 1. Provide plastic warning flag.
- D. Turnbuckles: 1/4" x 7-3/4" Galvanized steel with a 2-1/2" in. lengthwise opening fitted with eyebolts.

2.12 Antidesiccant

- A. Anti-desiccant shall be an emulsion specifically manufactured for plant protection which provides a protective film over plant surfaces which is permeable enough to permit transpiration. Anti-desiccant shall be delivered in manufacturer's sealed containers and shall contain manufacturer's printed instructions for use.

2.13 Fungicide

- A. Fungicide shall be sprayable broad-spectrum fungicide.

2.14 Insecticide

- A. Insecticide shall be horticultural oil spray for control of insects and mites.

2.15 Post-Emergent Herbicide

- A. Herbicide shall be a selective post-emergent herbicide.

2.16 Pre-Emergent Herbicide

- A. Herbicide shall be selective pre-emergent herbicide for ornamental plants, nursery stock and ground covers.

2.17 Drainage Gravel

- A. Clean #57 crushed stone.

2.18 Drainage Matting

- A. Drainage Matting with integral filter fabric to be Mira Drain 9000 as manufactured by Mirifi, Inc., Charlotte, North Carolina, (800) 438-1855, or approved equal.

2.19 Drainage Pipe

- A. 4" corrugated perforated polyethylene drain tubing with green stripe as manufactured by Advanced Drainage Systems (ADS) or equal.

Part 3 Execution

3.1 Examination of Subgrade

- A. Examine subgrade and rough grading before planting. Alert Design Professional to unacceptable rough grading or subgrade conditions.

3.2 Soil Drainage/Detrimental Soils

- A. Test drainage of five planting pits in locations agreed upon with the Design Professional. Pits shall be filled with water twice in succession. The time at which water is put into the pit for a second filling shall be noted. Design Professional shall then be notified of the time it takes for pit to drain completely. Planting operations shall not proceed until Design Professional has reviewed test drainage results.
- B. The Contractor shall notify the Design Professional in writing of all soil or drainage conditions that are considered detrimental to growth of plant material. Submit proposal and cost estimate for correction of the conditions for Design Professional's approval before starting work.

3.3 Layout of Planting Areas

- A. Individual plant locations and outlines of shrub and ground cover areas to be planted shall be staked by the Contractor in ample time to allow inspection by the Design Professional.
- B. Digging shall not begin until locations are approved by the Design Professional.
- C. Location of trees shall be staked using color coded stakes. A different stake color shall be used for each tree species.

3.4 Preparation of Subgrade

- A. Subgrade shall be brought to true and uniform grade and shall be cleared of stones greater than 1/2 in., sticks, and other extraneous material.
- B. Planting soil shall not be placed when subgrade or topsoil material are frozen, excessively wet, or excessively dry, or if weed growth exists. If weed growth develops sufficiently to prevent the proper plant bed preparation, they shall be mowed and removed from the site at no additional cost to the Owner.

3.5 Plant Pit Excavation

- A. Planting pits for trees and shrubs shall be excavated to the depth and dimensions indicated on the Drawings.
- B. Excavation shall not begin until locations are approved by the Design Professional.

- C. For balled and burlapped (B&B trees and shrubs), make excavations at least 4 feet wider than the ball diameter for the top 12" of the pit. For the remaining depth of the pit, excavate at least 2 feet wider than the ball diameter and equal to the ball depth, plus an allowance for setting of ball on a layer of compacted backfill. Allow for 6" minimum setting layer of excavated soil.
- D. Loosen hardpan and moisture barrier until hardpan has been broken and moisture is allowed to drain freely.
- E. Test Drainage
 - 1. Tree and specimen shrub pits: Fill every third tree pit with water. If percolation is less than 100% within a period of 12 hours, drill a 10" hole auger to a depth of 4 feet below the bottom of the pit. Fill auger hole with drainage gravel and cover with soil separator. Retest pit. In case drainage is still unsatisfactory, notify Landscape Architect, in writing, of the condition before planting trees in the questionable areas. Contractor is fully responsible for warranty of the trees and specimen shrubs.
 - 2. Dispose of subsoil removed from landscape excavations. Do not mix with planting soil. Do not use as backfill.

3.6 Spreading of Planting Soil

- A. Planting soil shall be spread and placed to required depths, as indicated on the drawings.
- B. Surfaces shall be graded and smoothed, eliminating all sharp breaks by rounding, scraping off bumps and ridges, and filling in holes and cuts.
- C. Prior to installing any planting soil mix, the Design Professional will approve the condition of the subgrade.
- D. In areas of soil installation, till the planting soil mix into the top layer of subgrade.
 - 1. Scarify or till the surface of subgrade to a depth of 2 – 3 in. with a backhoe or other suitable device.
 - 2. Spread a layer of the specified planting soil mix 2 – 3 in. deep over subgrade.
 - 3. Thoroughly till the planting soil mix and the subgrade together.
 - 4. Immediately install the remaining planting soil mix in accordance with the following specifications. Protect the tilled area from traffic. Do not allow tilled subgrade to become overly compacted.
 - 5. In the event that the tilled area becomes overly compacted, till the area again prior to installing the planting soil mix.
- E. Install the remaining planting soil mix in 8 – 10 in. lifts to the required depths.

- F. The depths and grades indicated on the Drawings are the final grades after settlement and shrinkage of the organic material. Contractor shall install the planting soil mix at a higher level to compensate for this anticipated reduction of planting soil volume depending upon the predicted settling properties of each planting soil mix type.

3.7 Planting Soil Compaction

- A. Compact each 8 – 10 in. lift with mechanical compaction equipment to the compaction rates indicated.
 - 1. Achieve a soil density of between 1.45 to 1.55 grams per cubic centimeter over dry weight divided by volume (80 to 85% of the standard proctor maximum dry density.)
 - 2. Planting mix compaction shall be tested at each lift using a cone penetrometer calibrated to the mock-up soil and its moisture level. The same penetrometer and moisture meter used for the testing of the mockup shall be used to test installed soil throughout the work.
 - 3. Maintain at the site a hand penetrometer with pressure dial and a soil moisture meter to measure the compaction rates relative to the mock-up soil compaction.
- B. Maintain moisture conditions within the planting mixes during installation to allow for satisfactory compaction. Suspend installation operations if the planting mix becomes wet. Do not place planting mixes on wet or frozen subgrade.
- C. Provide adequate equipment to achieve consistent and uniform compaction of the planting mixes. Use the smallest equipment that can reasonably perform the task of spreading and compaction.
 - 1. Testing shall be performed by the Contractor.
 - 2. Record the test results on a soil compaction log. This report shall include the location of the test. The depth of the test measures from the proposed finish grade, the penetrometer reading and the moisture meter reading.
 - 3. Submit the compaction log at the end of the soil installation period. Soil compaction log shall be kept current and available at the site for review at all times.

3.8 Planting

- A. Tree, shrub, and groundcover beds shall be excavated to the depth and widths indicated on the Drawings. If the planting pit for any tree is dug too deep, soil shall be added to bring it to correct level, and the soil shall be thoroughly tamped. Walls of plant pits shall be dug so that they are sloped as shown on the Drawings, and

- scarified. Do not excavate compacted subgrades of adjacent pavement or structures.
- B. Plants shall be set as indicated on Drawings. Plants shall be set so that the root flare is at, or slightly above, finished grade. Plants located in poorly drained soils shall be set 2 to 4 inches above finished grade, gradually sloping between the top of the root ball and the surrounding finished grade.
 - C. Plants shall be turned to the desired orientation when required by Design Professional.
 - D. Containerized plants shall be removed from container taking care not to damage roots.
 - E. The side of the root ball shall be scarified to prevent root-bound condition before positioning in planting pit.
 - F. Plants shall be positioned in center of planting pits, set plumb, and rigidly braced in position until all planting soil has been tamped solidly around the balls.
 - G. Pits shall be backfilled with planting soil. Soil shall be worked carefully into voids and pockets, tamping lightly every 6 in.
 - 1. When pit is two-thirds full, plants shall be watered thoroughly, and water left to soak in before proceeding.
 - 2. At this time, ropes, or strings on top of balls shall be cut and shall be pulled back. Loosen and remove burlap and biodegradable ropes from top half of root ball. Cut and remove the top half of all wire baskets before backfilling. Non-biodegradable ball wrapping, and support wire shall be totally removed from ball and planting pit.
 - H. Backfilling and tamping shall then be finished, and a saucer formed around plant pits as indicated on the Drawings.
 - I. Apply anti-desiccant using power spray to provide an adequate film over trunks, branches, stems, twigs and foliage. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again after planting as per manufacturer's recommendations.
 - J. Mulching: Immediately after planting work has been completed, mulch pits, trenches and planting beds. Provide a minimum depth of 2" bark or 3" pine straw. Finish edges according to detail.
 - K. Saucer shall be filled with water and water left to soak in. Saucer shall then be filled with water again, continue watering thereafter as necessary until Substantial Completion.

3.9 Flowering Plants

- A. Prepare flowering plant planting bed by application of fertilizers and pH-altering amendments and thoroughly rototilling into the top 12 in. prior to planting bulbs and flowering plants.

3.10 Perennials, Vines and Ground Cover

- A. Set out and space plants as indicated on the Drawings.
- B. Perennials: Dig at least 18" deep, but 12" is adequate. Work 4-6" compost into the top layers of soil by digging or tilling.
- C. Meadow Plants Dig at least 18" deep, but 12" is adequate. Work 4-6" humus into the top layers of soil by digging or tilling.
 - 1. Perennials: Check root ball after removing plant from its container. Encircling roots need to be gently loosened from the tight mat of root-bound plants. If roots are very dense at bottom of pot, slice off the bottom 1". If roots are seriously disturbed when planting, cut back some foliage to reduce the water stress that will occur. Plant at the same soil level as the plant was in its container.
- D. Vines: Check root ball after removing plant from its container. Encircling roots need to be gently loosened from the tight mat of root-bound plants. If roots are very dense at bottom of pot, slice off the bottom 1". If roots are seriously disturbed when planting, cut back some foliage to reduce the water stress that will occur. Plant at the same soil level as the plant was in its container.
- E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.11 Fertilizer Application

- A. Fertilizer, if required, shall be applied at the rates recommended by soil testing results, as specified in this Section.

3.12 Fungicide

- A. Fungicide, if required, shall be applied Immediately after planting, all trunks of deciduous trees shall be sprayed with fungicide, applied by chemical manufacturer.

3.13 Pre-Emergent-Herbicide

- A. Immediately after planting, pre-emergent herbicide shall be applied to ornamental shrub beds and around base of trees, in strict accordance with chemical manufacturer's printed instructions.

3.14 Post Emergent-Herbicide

- A. Upon the appearance of weeds within planted areas, pre-emergent herbicide shall be applied to ornamental shrub beds and around base of trees, in strict accordance with chemical manufacturer's printed instructions.

3.15 Insecticide

- A. Upon the appearance of insect problems, all trunks of deciduous trees shall be sprayed with insecticide, applied by chemical manufacturer.

3.16 Staking and Guying

- A. Each tree shall be staked or guyed immediately following planting. All evergreen trees and deciduous trees over 3" caliper shall be guyed. Plants shall stand vertical and plumb after staking or guying. Set vertical stakes and space to avoid penetrating root balls or root masses. Allow enough slack to avoid rigid restraint of tree. Stakes and guys shall be installed as indicated on the Drawings. Staking and guying shall not be used as a means to straighten trees.

3.17 Mulching

- A. Mulch shall be applied to depths and limits indicated on the Drawings.
- B. Mulch shall not be allowed to cover the base of trunks – maintain 2-3" of open space between mulch and tree trunk.

3.18 Pruning

- A. Each tree and shrub shall be pruned to preserve the natural character of the plant. Pruning shall be done after delivery of plants and after plants have been inspected and approved by the Design Professional. Pruning procedures shall be reviewed with Design Professional before proceeding.

3.19 Clean Up and Protection

- A. During Landscape Work, keep pavements clean and work area in an orderly condition.
- B. Upon completion of Work, clear grounds of debris, superfluous materials, and all equipment. Remove from Site to satisfaction of Landscape Architect and Owner.

- C. Protect Landscape Work and materials from damage due to landscape operations, operations by other contractors and trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged Landscape Work as directed at no additional cost to the Owner.
- D. Theft: Contractor is responsible for theft of plant material at the Project Site before, during and after planting, until the Date of Substantial Completion of the Work in total.

3.20 Inspection And Acceptance

- A. Periodic inspections will be made from time to time by the Owner's Representative to review the quality and progress of the work. Work found to be unacceptable must be corrected within five calendar days. Remove rejected plants and materials promptly from project site.
- B. Upon completion of Work, the Contractor shall notify the Owner's Representative and the Owner at least ten (10) days prior to requested date of inspection for Substantial Completion of all or portions of the Work. The Owner's Representative will issue a punch list for work to be corrected. All work in the punch list must be completed within five (5) working days from date of inspection. Where inspected Work does not comply with requirements, replace rejected Work and continue specified maintenance until re-inspected by the Owner's Representative and found to be acceptable.
- C. Certificate of Substantial Completion will be issued for acceptable Work. If punch list items are issued with the Certificate, they must be corrected within five (5) working days.
- D. One Year Warranty commences on the date of issuance of the Certificate of Substantial Completion.
- E. Final Acceptance: One year after Date of Substantial Completion of the Work in total the Owner's Representative and the Owner inspect the Work for Final Acceptance. Upon satisfactory completion of repairs and/or replacements the Owner's Representative certifies, in writing, the Final Acceptance of the Work. The Final Acceptance Certification issued by Owner's Representative will serve as evidence that Contractor's one-year warranty obligations have been met.

END OF SECTION

Part 1 General

1.1 Scope

- A. The work to be performed under this section of the contract will be the construction of various diameters by horizontal directional drilling.
- B. Horizontal Directional Drilling is defined as: A construction method consisting of drilling a small diameter pilot hole within the designed tolerances for radius requirements, followed by enlargement of the hole to accommodate the product line.
- C. The Contractor will furnish all labor, equipment, materials and supplies and will perform all work necessary to provide County with a complete, finished directional drill installation.
- D. The proposed alignment, length, profile and grade to which the pipe shall be installed are noted on the applicable drawings. This profile indicates the minimum grade to which the pipe will be installed.

1.2 Quality Assurance

- A. The requirements set forth in this Specification specify a wide range of procedural precautions necessary to insure that the basic, essential aspects of a proper directional drilling installation are adequately controlled. Strict adherence shall be required under specifically covered conditions outlined in this Specification.
- B. Adherence to the specifications contained herein, or the County's approval of any aspect of any directional drilling operation covered by this Specification, shall in no way relieve the Contractor of its ultimate responsibility for the satisfactory completion of the work authorized under the Contract.
- C. The Contractor shall employ experienced personnel to operate the directional drilling equipment and the position monitoring and steering equipment.
- D. The Contractor shall use certified pipe welders. These individuals shall be made available prior to construction for certification testing and qualifications. Welders shall be certified prior to commencement of pipe welding operations.

1.3 Submittals

- A. Prior to beginning work, the Contractor shall submit to the County five (5) copies of a report of schedules, calculations, procedures and any supplemental subsurface soil condition investigations performed by the Contractor along the path of the proposed crossing. The report will insure that the subsurface conditions are known to the Contractor and that his proposed crossing procedure is based on factual information. If the subsurface conditions are known to the Contractor by previous work or geotechnical studies done in the immediate area, the information shall be

recorded in the report along with any additional geotechnical studies performed by the Contractor.

B. The report shall include the following:

1. Contractor shall submit detailed design calculations for several representative loading conditions for the proposed crossing. If requested by the County, the Contractor shall submit calculations to support the design of any particular location of pipe anywhere along the length of the crossing at no additional cost to the County.
 - a. Design calculations shall be presented in a neat, readable format, with all figures, values and units included to facilitate ease of verification.
 - b. Calculations shall be submitted to demonstrate that the pipe thickness design is sufficient to meet all design criteria specified.
 - c. Calculations shall address the following loading conditions: Pre-installation - Hoop and longitudinal stress during low pressure air test, spanning stress with pipe full of water and supported on installation rollers, and maximum roller/ support spacing.
 - d. Installation/ Post-Installation - Longitudinal stress from pulling force; bending stress at point of entry and in final position; external stresses from drilling fluid, overburden, and highway or other loads being crossed.
 - e. Post-Installation/In-Service - Hoop and longitudinal stress during hydrostatic test; internal working and surge pressure; buckling with internal vacuum.
 - f. The Contractor shall also perform and submit to the County, fluid's pressure versus overburden strength calculations. These calculations shall be performed to determine minimum acceptable cover requirements and prevent drilling fluids breakout to the ground surface.
 - g. All calculations shall bear the seal of a Florida Certified Professional Engineer.
2. A list of equipment and procedures expected to be used for the directional drill installation, including special equipment and materials required for various soil conditions anticipated.
3. Time schedule for completing the directional drill installation, including any delays due to anticipated soil conditions.
4. A plan and profile drawing of the same horizontal and vertical scale as the contract drawing showing the proposed crossing configuration including entry and exit angles, radius of curvature and entry and exit points, including proposed equipment set-up, material layout, and construction staging areas.

1.4 Job Conditions

- A. Planned night time work is expressly prohibited and will not be allowed unless prior approval granted by the County and all regulatory agencies having jurisdiction.
- B. All operations shall be accomplished during daylight hours and shall not begin after the hour established as the latest starting time that will allow completion during daylight hours. The Contractor shall provide a Work Plan submittal indicating its proposed hours of operation and length of workweek. All work plans shall be subject to compliance with all applicable regulatory requirements for construction activities and any off site impacts.
- C. There shall be no directional drilling work performed on Fridays unless otherwise approved by the County and all regulatory agencies having jurisdiction.

Part 2 Products

2.1 Equipment

- A. General: All equipment for the directional drill installation shall have the capacity, stability, and necessary safety features required to fully comply with the specifications and requirements of this section without showing evidence of undue stress or failure. It shall be the responsibility of the Contractor to assure that the equipment to be used in the directional drill installation is in sound operating condition. Backup equipment shall be required in the event of an equipment breakdown and where the condition of the equipment to be used indicates that routine component replacement or repair will likely be necessary during the directional drill installation.
- B. Directional Drilling System: The directional drilling system shall consist of over the road transportable field power unit, mud-mixing and recycling unit, a trailer or carriage-mounted drill unit, and all other support accessory vehicles and equipment. All system components shall be in sound operating condition with no broken welds, excessively worn parts, badly bent, or otherwise misaligned components. All drill pipe, reamers, pull back heads, swivels, drill heads and collars, pipe cradles, pipe rollers, ropes, cables, clamps, and other non-mechanical but essential items shall be in sound condition and replaced immediately when need is apparent. The equipment must be capable of drilling the specified length in a single bore.
 - 1. Mud-Mixing and Recycle Units: The mud-mixing and recycle unit shall be a self-contained system designed to provide a supply of high-pressure bentonite based cutting fluid to the drill unit. It shall contain a fluid storage tank and a complete bentonite and drilling fluid additive(s) mixing system. The cutting fluid is to be mixed on site. The cutting fluid shall be formulated for this specific project and anticipated conditions. It shall permit changes to be made to the bentonite and drilling fluid additive(s) concentrations during drilling in response to changing soil conditions. The field power unit shall contain the power-taken off-driven high pressure cutting fluid pumping system. The recycle units shall be of a capacity to minimize the production of new cutting

fluid and maximize the reuse and recirculation of original cutting fluid produced.

2. Directional Drill System

- a. A carriage-mounted version of the drill system shall include a thrust frame. Both the trailer-mounted and carriage-mounted drill system shall be designed to rotate and push 10-foot (3-meter) minimum hollow drill sections into the tunnel being created by the boring head. The drill sections shall be made of a high strength S-grade steel that permits them to bend to a 30-foot (9-meter) radius without yielding. Drill end fittings shall permit rapid makeup of the drill sections while meeting the torque, pressure and axial load requirements of the system. The boring head itself shall be capable of housing a probe used by the Magnetic Guidance System (MGS) to determine tool depth and location from surface and to orient the head for steering. The MGS shall have a minimum accuracy of plus or minus two percent of the vertical depth.
- b. The drilling equipment may be fitted with a permanent alarm system capable of detecting an electric current. The system will have an audible alarm to warn the operator when the drill head nears electrified cables. The drilling equipment shall be grounded, protected, and operated in accordance with manufacturer's requirements for electric strike safety.
- c. The control console shall contain a calibrated display of inclination, azimuth, tool face location, mud pump rates, and torque pressures. The downhole steering system accuracy shall be plus or minus one percent of the horizontal bore length.

3. Restrictions: Other devices or utility placement systems for providing horizontal thrust other than those previously defined in the preceding sections shall not be used unless approved by the County prior to commencement of the work. The proposed device or system will be evaluated prior to approval or rejection on its potential ability to complete the pipe placement satisfactorily without undue stoppage and to maintain line and grade within the tolerances prescribed by the particular condition of the project. Water sluicing methods, jetting with compressed air, or boring or tunneling devices with vibrating type heads that do not provide positive control of the line and grade shall not be allowed.

- C. Spoils Equipment: The cutting fluid removal system shall include a self-contained vacuum truck which has sufficient vacuum and tank capacity to remove excess cutting fluid mixture and cuttings from the project site as required or directed by the County.

1. The Contractor shall be responsible for the offsite disposal of all surplus cutting fluid mixture, cuttings, soil and debris generated by the project. The surplus materials shall be removed, hauled and disposed in accordance with all regulatory agencies having jurisdiction.

- D. Magnetic Guidance System: A Magnetic Guidance System (MGS) probe and tracker shall be used to identify the location of the drill head during the drilling operation. The tracker shall be capable of tracking at all depths up to one hundred feet and in any soil condition, including hard rock. It shall enable the driller to guide the drill head by providing immediate information on the tool face, azimuth (horizontal direction), and inclination (vertical direction). The tracker shall be accurate to $\pm 2\%$ of the vertical depth of the borehole at sensing position at depths to one hundred feet. Ferrous materials shall not influence or affect the MGS readings or accuracy.
1. Components: The Contractor shall supply all components and materials to install, operate, and maintain the MGS. This shall include, but not be limited to the following:
 - a. MGS Probe and Interface
 - b. Computer, Printer, and Software
 - c. DC Power Source, Current Control Box, and Coil/Tracking Wire.
 2. The Magnetic Guidance System (MGS) shall be a Tensor TruTracker MGS, or other licensed and approved wire guidance system, and shall be set up and operated by personnel experienced with this system. "Walk-over" tracking systems shall not be used, except as approved by the County. Contractor shall provide County with current calibration certification of MGS in accordance with manufacturer's specifications.
- E. If equipment breakdown or other unforeseen stoppages occur and forward motion of the directional cutting head is halted at any time other than for reasons planned in advance (addition of drill stems, etc.), the boring path shall be filled with a proper bentonite solution immediately, or as directed by the County.
- F. The boring tool shall have steering capability and have an electronic tool detection system. The position of the tool during operation shall be capable of being determined accurately, horizontally within 1% of the horizontal distance of the borehole and vertically within 2% of the vertical depths of the borehole. The boring tool shall have a nominal steering radius of 9 meters (30 feet).

2.2 Pipe

- A. Pipe of various sizes (4-inch to 36-inch) shall be DIPS DR11 Pressure Class (PC) 200 High Density Polyethylene (HDPE) Pipe, AWWA C906 compliant, NSF 61 Standard Listed, furnished in fifty (50) foot lengths or longer. Pipe larger than 36 inches will be determined by Bay County on a case by case basis for meeting operational requirements.
- B. HDPE piping shall have stripes applied to the pipe wall. Stripes shall be parallel to the axis of the pipe, continuous, and be located at no greater than 90 degree intervals around the outside of the pipe. Stripes for water pipe shall be blue, stripes for sewer shall be green, and stripes for reclaimed water lines shall be purple.

- C. Fusible PVC Pipe of various sizes (4 inch to 24 inch) shall be DIPS DR18 Fusible C905. 30-inch and larger will be determined by Bay County on a case by case basis for meeting operational requirements.
- D. Joints of pipe segments shall be butt-welded flush to the outside diameter of the pipe.

2.3 Polyethylene Mechanical Joint Adapters

- A. Mechanical connections of HDPE pipe to ductile iron on PVC piping, mechanical joint fittings, or valves shall be through a self-restraining, fusible mechanical joint adapter. Restraints shall be used when connecting a HDPE pipe to a different material.
- B. Adapter shall include an integral, internal stainless steel insert.
- C. Adapter shall be of the same SDR as the pipe.

2.4 Drilling Fluids

- A. A mixture of Bentonite drilling clay, project specific cutting fluid additives, and potable water is to be used as the cutting fluid (MUD) and over ream hole filler for the directional drill installation. The drilling fluid mixture used shall have the following minimum viscosities as measured by a Marsh Funnel:
 - 1. Rock Clay 60 sec.
 - 2. Hard Clay 40 sec.
 - 3. Soft Clay 45 sec.
 - 4. Sandy Clay 90 sec.
 - 5. Stable Sand 120 sec.
 - 6. Loose Sand 150 sec.
 - 7. Wet Sand 150 sec.
- B. These viscosities may be varied to best fit the soil conditions encountered as recommended by the drilling mud and fluid additive manufacturer, and as approved by the County.
- C. Where sandy or granular materials are encountered, a cement slurry or polymer supplement shall be considered for added strength and stability of the bore and over ream hole.
- D. No chemicals or polymer surfactant shall be used in the drilling fluid without written consent of the County, and after a determination is made that the chemicals to be added are not harmful nor corrosive to the facility and are environmentally safe.

- E. Contractor to provide County and have on site at all times the Material Safety Data Sheets (MSDS) for all drilling compounds and chemicals.

Part 3 Execution

3.1 Personnel Requirements

- A. A competent and experienced supervisor representing the Drilling Contractor shall be present at all times during actual operations. A responsible representative, who is thoroughly familiar with the equipment and type work to be performed, must be in direct charge and control of the operation at all times. In all cases the supervisor must be continually present at the job site during the actual Directional Pilot Hole, over reaming and pullback operations.
- B. The Contractor shall have a sufficient number of competent workers on the job at all times to insure the Directional drill installation is made in a timely and satisfactory manner. Adequate personnel for carrying out all phases of the actual Directional drill installation operation must be on the job site at the beginning of work.
- C. HDPE pipe thermal butt fusion welding to be completed by a welder certified by the manufacturer of the pipe or pipe welding equipment.
- D. The County must be notified 48 hours in advance of starting each phase of the work. The Directional drill installation shall not begin until the County is present at the job site and agrees that proper preparations for the operation have been made. The County's approval for beginning the installation shall in no way relieve the Contractor of the ultimate responsibility for the satisfactory completion of the work as authorized under the Contract.
- E. If the Contractor fails to begin the Directional drill installation at the agreed time, the County will establish the next mutually convenient time to begin. To avoid undue hardship of either party, reasonable and mutual cooperation should be exercised where starting times are concerned. If one party fails to meet the agreed schedule, the other party is expected to consider a delayed start if the installation cannot be completed during daylight hours.

3.2 Delivery, Storage, and Handling

- A. Transport, store and handle pipe segments so as to avoid damaging the surfaces, protective coatings, edges and corners, and to prevent excessive stresses.
- B. Handle pipe by lifting using nylon slings or other non-metallic contact means. Use of lifting eyelets is not permitted.
- C. Use supports as needed when storing pipe segments to avoid damage. Store pipe in accordance with the manufacturer's written recommendations.

3.3 Installation

- A. The Contractor shall be responsible for providing a FDOT Maintenance of Traffic (MOT) Plan to the County and local traffic law enforcement agency for review. The MOT Plan shall show the location of all barricades, signs, devices and alternate routes for local traffic and pedestrian safety. Erection of the appropriate safety and warning devices in accordance with the USDOT/ FHWA Manual on Uniform Traffic Control Devices (MUTCD) shall be completed prior to beginning work and maintained until all construction is completed and the site restored.
- B. All excavation for entry and recovery pits and any other excavation necessitated by the Directional drill installation shall be in accordance with the Earthwork for Utility section of the specifications. All excavations shall comply with the requirements of the Occupational Health and Safety Administration.
- C. The cost of restoring pavement, curb, sidewalk, driveways, lawns, storm drains, etc., and other landscaped facilities shall be borne by the Contractor unless otherwise noted.
- D. The following is a general outline of steps for the directional drill installation operation:
 - 1. Contractor shall clear the right-of-way and temporary work space as shown on the drawings. Contractor to install and maintain all soil erosion and sediment control devices, until project completion with approved permanent site stabilization.
 - 2. Contractor shall haul, string, assemble restrained pipe, joint air test and hydrostatically test the pipeline in one section, unless otherwise approved by County. The Contractor shall provide adequate site security and shall be responsible for the integrity of the pipe until after the pullback, final test of the pipeline, and acceptance of the work by the County.
 - a. All assembled pipe sections shall be securely plugged at the end of each work day. The pipe interior is to be protected at all times against dirt, dust, drilling mud, pipe cuttings, debris, animal access, and other sources of contamination.
 - 3. Contractor shall provide adequate support rollers for the pipeline during pullback of the pipe string into the pre-drilled hole. The rollers and cradles shall be of a type that will prevent damage to the pipe and will be of sufficient number, as recommended by pipe manufacturer, to prevent over stressing due to sag bends during the pullback procedure. The pipe shall be supported at all times, including pullback, to maintain a stress free arc which limits pipe bending and internal hoop stresses to within manufacturer's limits.
 - a. Pipe which is not properly protected and supported and shows indications of excessive stressing, gouges, cuts, abrasions or other damage which may affect the operational performance intended for the

- pipe, as recommended by pipe manufacturer, shall be removed from the site and replaced at no additional cost as directed by the County.
4. Contractor will mobilize the drilling equipment, erect the rig, drill a pilot hole, enlarge the hole as necessary to a minimum diameter of 1.5 (may be less, based on Department of Transportation permit requirements) times the nominal diameter of the pipe, and pullback the prefabricated pipe length under the crossing.
 - a. Prior to beginning the Pilot Hole over reaming, the Contractor shall furnish an as-built plan and profile of the actual crossing to the County confirming the installation is in compliance with the Contract Documents.
 5. Contractor will supply portable mud tanks or construct temporary mud pits to contain excess drill fluids during construction. Mud pits are to be protected at all times against unauthorized access and be stabilized at all times against surface water runoff and containment berm failure. Contractor will pump, haul and dispose any drill cuttings and excess drill fluids in a manner consistent with the local and state regulations at no additional cost to the County.
 6. The bore pipe will be pulled back in one continuous section and Contractor must utilize a swivel to minimize the rotation of the product pipe during pullback. Swivel shall utilize lubricated internal bearings which are fully protected from external contamination and over lubrication. Contractor must demonstrate swivel operation prior to pullback.
 - a. If pipe flotation is experienced during pullback, Contractor shall use potable water and disinfect all piping and hoses used for water addition to the HDPE to counter the pipe flotation during pullback.
 - b. During pullback, the Contractor shall maintain records for submission to County indicating job, date, time, constant pipe footage progress, mud flow rates, pulling forces required and torque readings. Contractor shall also record the pull head location for each length of drill stem pipe on the record drawings. During pullback, the Contractor shall use a #10 tracer wire for future locating needs.
 7. County shall have access at all times to any measuring or gauging devices used for the horizontal directional drill installation, as well as any drilling logs maintained by the Contractor.
 8. In the event that the Contractor must abandon the drill hole before completion, the Contractor will seal the borehole with neat cement grout starting at the low point or end of the drill hole and redrill, at no extra cost to County.

3.4 Pipeline Alignment and Profile Tolerances

- A. Ground entry and exit angles shall be as identified in the boring plan.

- B. Minimum bending radius of the installed pipeline shall be based on no more than 72% of the manufacturer's specified minimum yield strength of the pipe.
- C. The actual exit point shall be no more than 1 foot left or right of the alignment for the proposed exit point.
- D. Contractor shall limit the longitudinal pull on the pipe to not exceed pipe manufacturer's recommended bending/pulling bending/pulling force in force of the pipe, unless otherwise approved by the pipe manufacturer or its authorized representative. Contractor will continuously monitor and record the longitudinal pulling forces during pipeline pullback.
- E. Variation from the above parameters shall not be permitted without authorization of the County.

3.5 Field Quality Control

- A. The newly installed pipes shall be flushed with potable water to remove any sediment, solids and/ or foreign material prior to any in place testing. County's representative to be notified 48 hours prior to flushing.
- B. Hydrostatic Test (In-place pipe - After Pipe Pullback)
 - 1. Testing, flushing and disinfection and disposal of highly chlorinated water shall be in accordance with Section ASTM F2164 "Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure."
 - a. Prior to pipeline disinfection, the pipe shall be thoroughly cleaned of all internal debris, fluids, and all other material by flushing and/or use of uncoated polyfoam pipeline swabs/pigs.
 - 2. Fill the pipe with potable water and after all free air is removed from the test section; raise the pressure at a steady rate to 150 psi as measured at the lowest point. The pressure in the section shall be measured with calibrated pressure gauges at each end of the pipe section.
 - a. Once test pressure is attained and holds for four hours, reduce pressure by 10 PSI and monitor pressure for one hour for any deviation; if no deviation occurs, a passing test is indicated. No retesting of the HDPE shall take place for eight hours, minimum, after pipe has been depressurized due to an unsuccessful pressure test.
 - 3. Immediately following the pressure test, the results shall be furnished to the County. Leaking pipes that cannot be repaired to meet pressure test are to be filled with concrete, removed, or otherwise placed out of service.

3.6 Use of Existing Water Systems

- A. All use of existing water systems during construction by the Contractor shall be with the approval and direction of the system Owner and its representatives. The Contractor shall be responsible for all permits, fees, temporary meter rental/provisions, temporary backflow preventer rental/ provision and other water utility requirements for supplying water during construction. The Contractor shall use the existing water system only at locations, times and conditions as set forth by the system owner or its representatives.

3.7 Record Drawings

- A. The MGS pullback data shall be recorded at every pilot hole drill stem length during the actual crossing operation. The Contractor shall furnish record plan and profile drawings, on the same horizontal and vertical control datum shown on the contract documents, based on these recordings showing the actual location horizontally and vertically of the installation, and all utility facilities found during the installation.
- B. The record drawings shall be generated using AutoCAD, and provided on a DVD-ROM disc. Two hard copies of the approved record drawings shall be furnished to the County.

3.8 Cleanup and Restoration

- A. Perform restoration as the work progresses and after completion. Do not delay restoration work. Complete restoration no later than 30 days after the pipe is in place.

3.9 Drilling Underneath Water Bodies

- A. Place double rows of silt fence between all drilling operations and any areas that could be damaged, wetlands, or other waterways.
- B. Berms, liners, turbidity curtains, and other measures shall be used in order to contain any hydraulic or drilling fluid spills.
- C. Fuel may not be stored in containers greater than 25 gallons within 200 feet of any waterway or wetlands.
- D. Contractor shall adhere to all applicable local, state, and federal environmental regulations.

END OF SECTION

Part 1 General

1.1 Work Included

- A. All works shall be performed in accordance with Owner requirements.
- B. Furnish and install modular precast concrete manhole sections, with tongue-and-groove joints, with masonry transition to lid frame, covers, anchorage and accessories.

1.2 Related Sections

- A. Section 31 20 00 - Earthwork
- B. Section 31 23 33 - Trenching and Backfilling

1.3 Qualifications

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

1.4 Submittals

- A. Submit as required by Owner.
- B. Shop Drawing: Indicate manhole locations, elevations, piping, and sizes and elevations of penetrations.
- C. Product Data: Provide manhole covers, component construction, features, configuration, and dimensions.
- D. Certification for Fiberglass Reinforced Polyester (FRP) Manholes: As a basis of acceptance, the FRP manhole manufacturer shall provide an independent certification which consists of a copy of the manufacturer's test report accompanied by a copy of the test results that the manhole has been sampled, tested, and inspected in accordance with the provisions of the specification of ASTM D 3753 and meets all requirements.

Part 2 Products

2.1 Concrete Materials

- A. Cement Mortar: Cement mortar shall conform to ASTM C270, Type M with Type II cement.
- B. Portland Cement: Submit certificates of compliance stating the type of cement used in manufacture of concrete pipe, fittings, and precast manholes. Portland cement

shall conform to ASTM C150/C150M, Type II for concrete used in concrete pipe, concrete pipe fittings, and manholes, and type optional with the Contractor for cement used in concrete cradle, concrete encasement, and thrust blocking. Where aggregates are alkali reactive, as determined by Appendix XI of ASTM C33/C33M, a cement containing less than 0.60 percent alkalis shall be used.

- C. Portland Cement Concrete: Portland cement concrete shall conform to ASTM C94/C94M, compressive strength of 4000 psi at 28 days, except for concrete cradle and encasement or concrete blocks for manholes. Concrete used for cradle and encasement shall have a compressive strength of 2500 psi minimum at 2 days. Concrete in place shall be protected from freezing and moisture loss for 7 days.

2.2 Manholes

- A. General: Manholes shall be cylindrical, with a 48" minimum inside diameter. Increase diameter as indicated on drawings. Provide eccentric cone top sections.
- B. Precast Concrete Manholes:
 - 1. Precast concrete manhole risers, base sections, and tops shall conform to ASTM C478; except that the minimum wall thickness shall be 6".
 - 2. Base and first riser shall be monolithic.
 - 3. The manhole sidewall shall be of a length such that a minimum of one course and a maximum of 2 courses of bricks shall be placed on top of the unit to bring the casting to grade. A precast concrete adjusting ring may be used for this purpose, conforming to the height ranges specified for brick.
 - 4. Precast manholes are to be manufactured by Cloud, Sherman Dixie or approved equal.
 - 5. Plastic Gasket for Precast Manholes: Preformed plastic gasket shall meet or exceed all requirements of FS SS-S-210-A, "Sealing Compound, Preformed Plastic for Pipe Joints," Type I, and ASTM C990, rope formed. It shall be supplied in extruded rope form of suitable cross section and in such sizes as to seal the joint space when the manhole sections are installed. The sealing compound shall be protected by a suitable removable 2-piece wrapper, which shall be designed so that half may be removed longitudinally without disturbing the other half in order to facilitate application of the sealing compound. The flexible plastic gasket shall also meet the requirements of the following table:

Property	Test Method	Minimum	Maximum
Specific Gravity @ 77°F	ASTM D71	1.20	1.30
Ductility @ 77°F (5 cm/min)	ASTM D113	5.0	--
Softening Point (°F)	ASTM D36	320	--
Penetration @ 77°F (cm) (150 g-5 secs.)	ASTM D217	50	120

- C. **Throat Rings:** Adjustment throat rings shall be precast non-reinforced concrete rings having a maximum thickness of two inches (2"). The internal diameter shall not be less than twenty-four inches (24"), and the width shall be a minimum of five inches (5"). No more than six throat rings shall be used on any manhole.
- D. **Gaskets and Connectors:** Gaskets for joints between manhole sections shall conform to ASTM C443. Resilient connectors for making joints between manhole and pipes entering manhole shall conform to ASTM C923, and shall be Trelleborg Kor-N-Seal I with Korband Expander, or approved equal.
- E. **External Preformed Rubber Joint Seals:** An external preformed rubber joint seal shall be an accepted method of sealing cast iron covers to precast concrete sections to prevent ground water infiltration into sewer systems. All finished and sealed manholes constructed in accordance with paragraph entitled "Manhole Construction" shall be tested for leakage in the same manner as pipelines. The seal shall be multi-section with a neoprene rubber top section and all lower sections made of Ethylene Propylene Diene Monomer (EPDM) rubber with a minimum thickness of 60 mils. Each unit shall consist of a top and bottom section and shall have mastic on the bottom of the bottom section and mastic on the top and bottom of the top section. The mastic shall be a non-hardening butyl rubber sealant and shall seal to the cone/top slab of the manhole/catch basin and over the lip of the casting. Extension sections shall cover up to two more adjusting rings. Properties and values are listed in the following tables:

Physical Properties	Test Methods	EPDM	Neoprene	Butyl Mastic
Tensile, psi	ASTM D412	1840	2195	
Elongation, %	ASTM D412	553	295	350
Tear Resistance, ppi	ASTM D624 (Die B)	280	160	
Rebound, %, 5 minutes	ASTM C972 (mod.)			11
Rebound, %, 2 hours	ASTM C972			12

Properties, Test Methods and Minimum Values for Rubber used in Preformed Joint Seals

2.3 Metal Items

- A. **Cast Iron Frames, Covers, and Gratings for Manholes:**
1. Frames and covers shall be ASTM A48, Class 30B cast iron or ductile iron, made accurately to the required dimensions; sound, smooth, clean, and free from blisters and other defects; not plugged or otherwise treated to remedy

defects; machined so that covers rest securely in the frames with no rocking and are in contact with frame flanges for the entire perimeter of the contact surfaces; thoroughly cleaned subsequent to machining and before rusting begins; and with the actual weight in pounds stenciled or printed by the manufacturer on each casting in white paint.

2. Unless otherwise shown on plans, castings shall be Neenah R-1642, or equal, with clear inside diameter of 24 inches. The frames and covers shall have a combined weight of not less than 400 pounds.
3. Unless otherwise shown on plans, watertight castings shall be Neenah R-1915-G or equal, with clear inside diameter of 24 inches.
4. Refer to Standard Drawing for cover size and lettering.

B. Manhole Steps

1. Steps, if required shall conform to 29 CFR 1910.27. As an option, plastic, or rubber coating pressure-molded to the steel may be used. Plastic coating shall conform to ASTM D4101, copolymer polypropylene. Rubber shall conform to ASTM C443M ASTM C443, except shore A durometer hardness shall be 70 plus or minus 5. Aluminum steps or rungs will not be permitted. Steps are required in manholes greater than 4 feet deep.

Part 3 Execution

3.1 Examination

- A. Verify items provided by other sections of Work are properly sized and located.
- B. Verify that built-in items are in proper location, and ready for roughing into Work.
- C. Verify excavation for manholes is correct.

3.2 Preparation

- A. Coordinate placement of inlet and outlet required by other sections.
- B. Excavate for manhole in accordance with Section 31 20 00 – Earthwork.

3.3 Placing Manhole Sections

- A. Level base area and place minimum twelve inches (12") compacted bedding.
- B. Concrete Manholes:
 1. Construct base slab of cast-in-place concrete or use precast concrete base sections. Make inverts in cast-in-place concrete and precast concrete bases

with a smooth-surfaced semi-circular bottom conforming to the inside contour of the adjacent sewer sections.

2. For changes in direction of the sewer and entering branches into the manhole, make a circular curve in the manhole invert of as large a radius as manhole size will permit.
 3. For cast-in-place concrete construction, either pour bottom slabs and walls integrally or key and bond walls to bottom slab. No parging will be permitted on interior manhole walls.
 4. For precast concrete construction, make joints between manhole sections with the gaskets specified for this purpose. Parging will not be required for precast concrete manholes.
 5. Make joints between concrete manholes and pipes entering manholes with the resilient connectors specified for this purpose; install in accordance with the recommendations of the connector manufacturer.
 6. Where a new manhole is constructed on an existing line, remove existing pipe as necessary to construct the manhole. Cut existing pipe so that pipe ends are approximately flush with the interior face of manhole wall, but not protruding into the manhole. Use resilient connectors as previously specified for pipe connectors to concrete manholes.
- C. Coordinate with other sections of Work to provide correct size, shape, and location.
- D. Backfill manhole in accordance with Section 31 23 33 - Trenching and Backfilling.

3.4 Masonry Construction

- A. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- B. Lay masonry units in running bond.
- C. Form flush mortar joints.
- D. Lay masonry units in full bed of mortar, with full head joints, uniformly jointed with other Work.
- E. Set cover frames and covers level without tipping, to correct elevations.
- F. Coordinate with other sections of Work to provide correct size, shape, and location.
- G. Backfill manhole in accordance with Section 31 23 33 - Trenching and Backfilling.

END OF SECTION

ADDENDUM NO. 1
SOUTHPORT SPORTS COMPLEX
BAY COUNTY
FLORIDA

A. CONTRACT DOCUMENTS REVISIONS:

This addendum includes the following revisions to the Contract Documents:

1. Add the following language to Specification Section 00 21 14, Supplementary Instructions to Bidders – Sports Field Contractors, Section 1.1 General:
 - D. Bidders to be aware that prior to the Notice to Proceed for the project, the Owner will import, spread, and compact borrow fill material and raise existing grades above those shown on the drawings.
 - E. Unit Prices shall be for work as specified in the bid documents for imported fill material and on-site unclassified excavation at a unit rate that the contractor considers all-inclusive of manpower, equipment, overhead and profit for the identified item.
 - F. The estimated quantities for items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities completed.
 - G. Contractor will receive a copy of updated existing surface survey files once fill operations are complete and is directed to only start earthwork activities after those survey files are received by the contractor.
 - H. Contractor will receive a copy of final as-built elevation survey files once the project is completed. Final payment for Unit Price Work to be determined by the Engineer for imported fill material and on-site unclassified excavation.
 - I. Contractor will receive a copy of all available geotechnical test reports for fill operations on the site completed by the Owner prior to the Notice to Proceed.
2. Replace Specification Section 01 11 00-2 Summary of Work, Section 1.3, A. 1. With the following sentence: Site and ballfield furnishings listed under the manufacturer heading in the materials schedule on sheet L7.01 as By Others or By Owner will be provided to the contractor. All other items will need to be furnished by the Contractor.

Bidder Must Acknowledge Receipt of this Addendum on Bid Form